A CULTURAL RESOURCES OVERVIEW FOR THE RIO GRANDE AND TIJUANA RIVER FLOOD CONTROL PROJECTS

Under contract to

United States Section, International Boundary and Water Commission
4171 North Mesa Street, Suite C-100
El Paso, Texas 79902
Contract No. IBM04D0001, Task Order No. IBM04T0015

In collaboration with

Camp Dresser and McKee, Inc.
1925 Palomar Oaks Way
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Submitted by

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GEO-MARINE INCORPORATED

July 2005

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by

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Duane E. Peter
Principal Investigator

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

This document is a cultural resource overview in support of a Draft Programmatic Environmental Impact Statement (PEIS) sponsored by the United States International Boundary and Water Commission (USIBWC) for proposed projects along the Rio Grande in Texas and New Mexico, and the Tijuana River in California. Geo-Marine, Inc., conducted this work as a subcontractor to Camp Dresser and McKee under Contract No. IBM04D0001, Task Order IBM04T0015. The project summarizes previous work conducted by the USIBWC and other researchers and includes a literature review of relevant sections of 382 miles of the Rio Grande (Rio Grande Canalization Project, the Rio Grande Rectification Project, the Presidio-Ojinaga Flood Control Project, the Lower Rio Grande Flood Control Project) and five miles along the Tijuana River between the U.S.-Mexico Border and the Pacific Ocean (International Tijuana Flood Control Project.)

Site records on file at various repositories were researched to determine the nature, locations, and extent of known sites within a one-half mile corridor on each side of the river within the boundary of the United States. A total of 299 known cultural resource properties exist within these parameters. Environmental and cultural overviews provide contexts for identifying data needs and criteria for establishing National Register of Historic Places significance.

ACKNOWLEDGEMENTS

This document would not have been possible without the help of a number of individuals. First, we would like to thank Daniel Borunda and Steve Fox, of the United States section of the International Boundary and Water Commission office in El Paso, Texas, for their help in obtaining needed reference documents. Duane Peter served as the principal investigator and provided valuable advice and comments on the written material. Melinda Landreth was responsible for technical editing. Martin Goetz generated the maps for the project and Sonia Padilla contributed reference formatting and data entry. We would also like to thank the Archaeological Records Management Section, the Texas Archeological Research Laboratory, and the California Historic Resources Information System for their help in providing previously recorded site data.

CHAPTER 1
INTRODUCTION

by
Victor Gibbs

This document provides a cultural resource overview in support of a Draft Programmatic Environmental Impact Statement (PEIS) sponsored by the United States Section of the International Boundary and Water Commission (USIBWC) for proposed projects along the Rio Grande in Texas and New Mexico, and the Tijuana River in California (Figure 1.1). Geo-Marine, Inc., conducted this review as a subcontractor to Camp Dresser and McKee, Inc., under Contract No. IBM04D0001, Task Order IBM04T0015.

This report summarizes previous investigations undertaken by the USIBWC and other researchers. It includes a cultural resources literature review of relevant sections of 382 miles of the Rio Grande and five miles along the Tijuana River (Appendix A). Searches of site files were conducted at various repositories to determine the nature, locations, and extent of known sites in a one-half mile corridor on either side of the river within the United States boundaries. This effort resulted in the identification of 299 previously recorded cultural properties. These data, along with environmental and cultural contexts, provided the background necessary to identify substantial gaps in current archaeological understanding of sites within the USIBWC project areas.

PROJECT LOCATIONS

Four of the five flood control projects are located along the Rio Grande, from Percha Dam, just south of Caballo Lake in New Mexico, to the Gulf of Mexico. The final area is along the Tijuana River, in California. These sections are described in detail below.

Rio Grande Canalization Project Area

The Rio Grande Canalization Project Area includes a 104.5 mile-long section of the Rio Grande, beginning approximately at Percha Diversion Dam in Sierra County, New Mexico, and ending at the American Diversion Dam, in El Paso County, Texas (Figures 1.2 – 1.4). The project began in 1938 and was completed in 1943, as part of water treaty agreements with Mexico that were established on May 21, 1906. The Canalization Project provides water and flood control to the Rincon and Mesilla valleys in New Mexico, the El Paso Valley in Texas, and the Juarez Valley in Mexico. Project features within the corridor consist of 130 miles of flood control levees, 27 bridges and five dams built on adjacent arroyos between 1969 and 1975 to control sediment and flood runoff (USIBWC 2005 [website]). Several diversion dams and associated canal systems

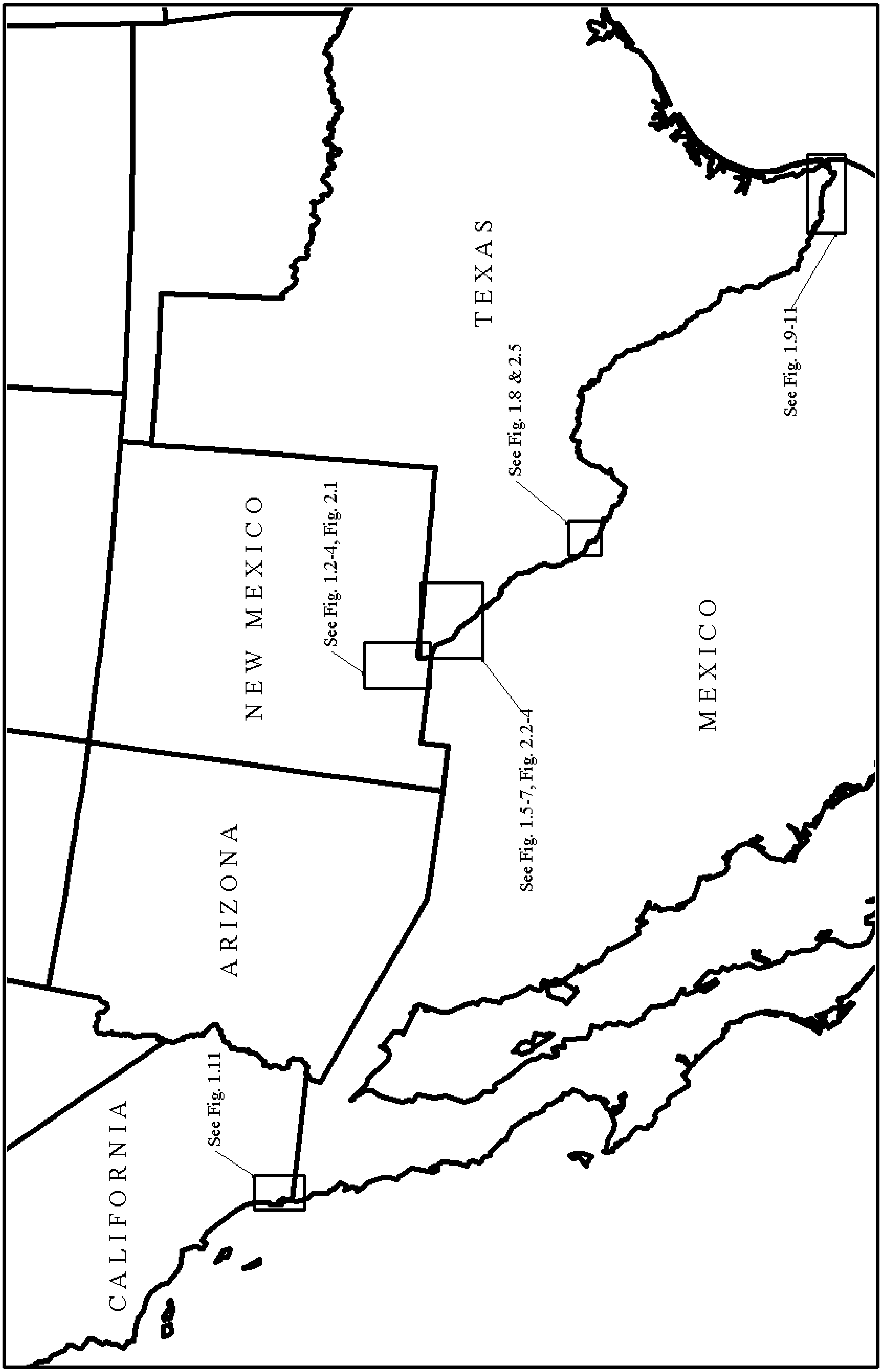

Figure 1.1. Project location map.

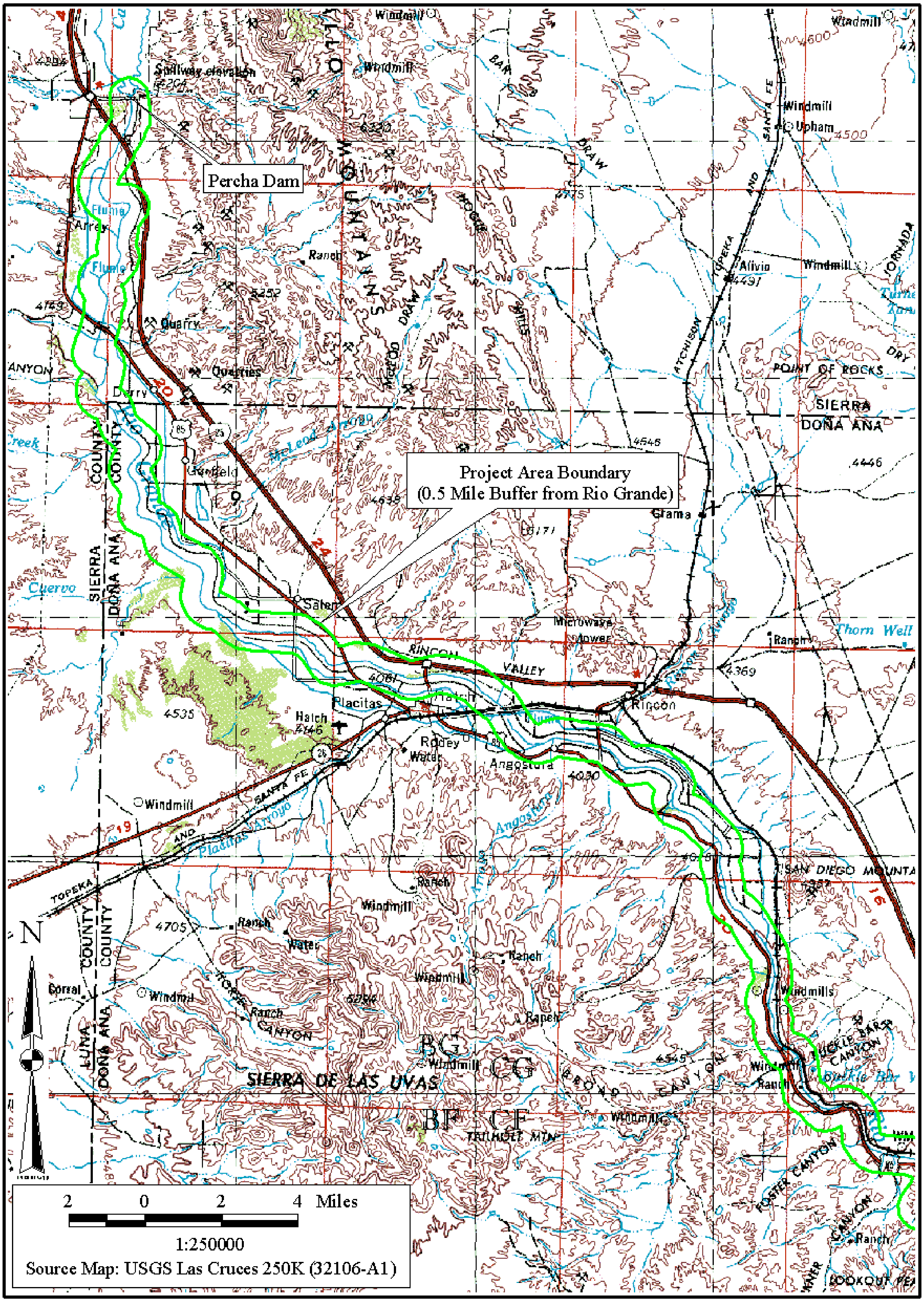

Figure 1.2. Project area map showing northern portion of the Rio Grande Canalization Project Area.

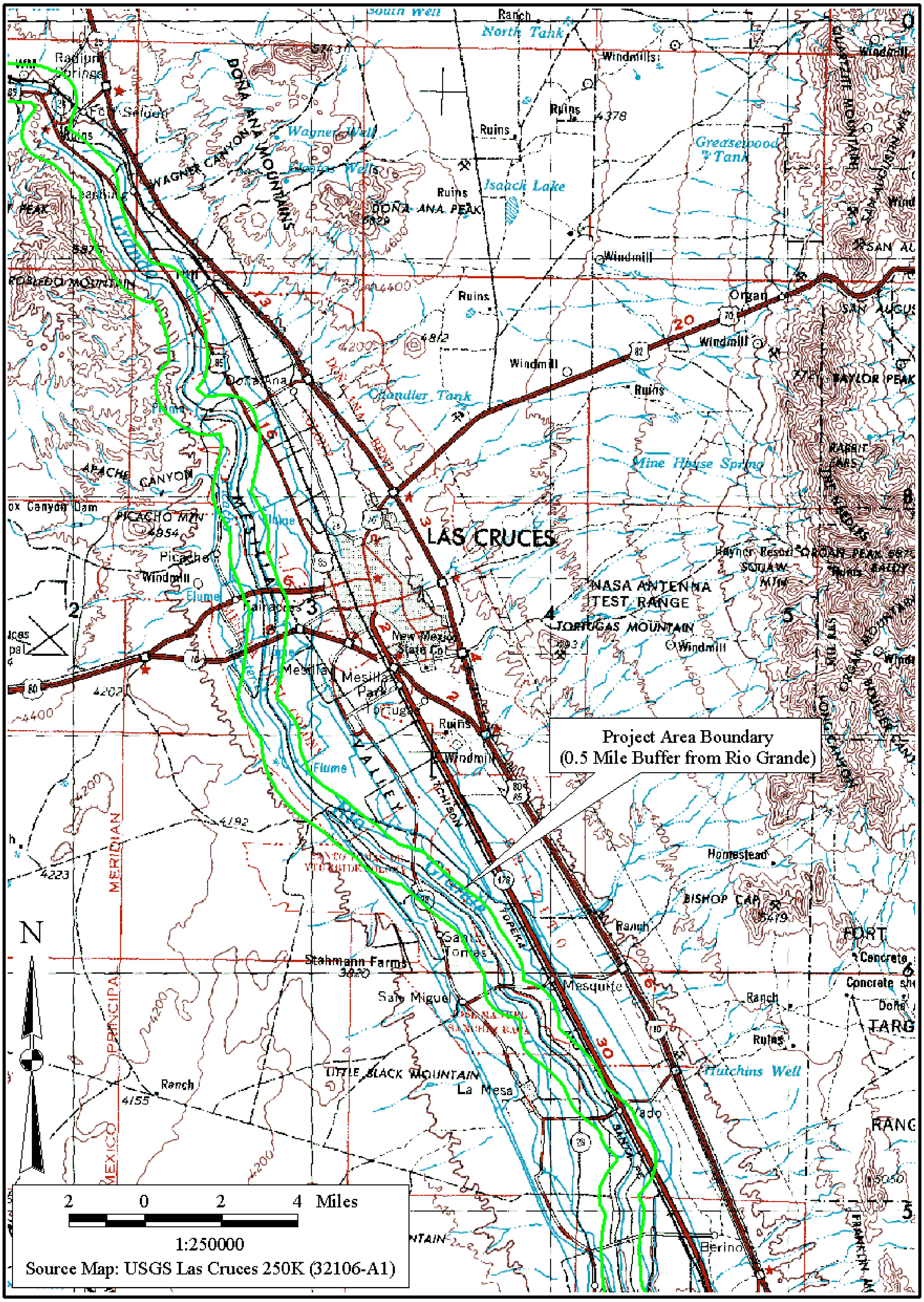

Figure 1.3. Project area map showing central portion of the Rio Grande Canalization Project Area.

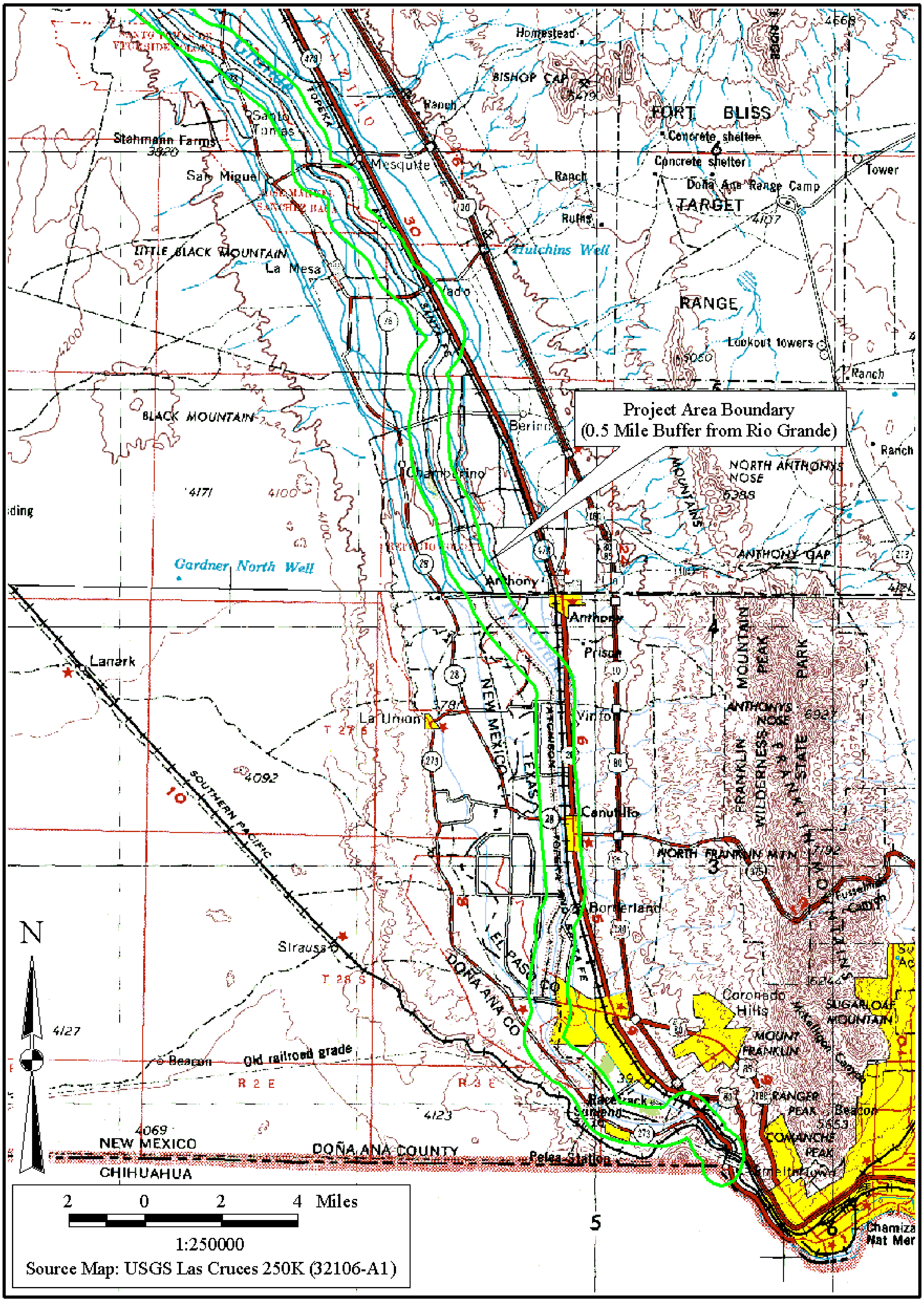

Figure 1.4. Project area map showing southern portion of the Rio Grande Canalization Project Area.

exist along this portion of the river, including the Percha Diversion Dam (1914-1919), the Leasburg Diversion Dam (1906-1908), the Mesilla Diversion Dam (1914-1919), and the American Diversion Dam (1935).

Rio Grande Rectification Project Area

The Rio Grande Rectification Project Area includes an 85.6 mile-long section of the Rio Grande, beginning at the American Diversion Dam in El Paso County, Texas, and ending near Fort Quitman, Hudspeth County, Texas (Figures 1.5 - 1.7). The project began with the signing of the Rio Grande Rectification Treaty between the United States and Mexico on February 1, 1933, and was completed in 1938. During the project, the segment of the river was shortened from 155.2 miles to 85.6 miles. Significant diversion features along this segment of the river include the American Diversion Dam (1935), the International Dam, the Franklin Canal (1889-1890, 1914-1915), and the Riverside Dam.

Presidio-Ojinaga Flood Control Project Area

The Presidio-Ojinaga Flood Control Project Area consists of a 15-mile section of the Rio Grande, six miles upstream and downstream from the sister towns of Presidio, Presidio County, Texas, and Ojinaga, Chihuahua, Mexico (Figure 1.8). The flood control project, which consisted of river straightening and levee construction, was completed in 1975 (Holiday and Ivey 1974).

Lower Rio Grande Flood Control Project Area

The Lower Rio Grande Flood Control Project Area (LRGFCP) extends from Penitas, Hidalgo County, Texas to the eastern portion of Cameron County where the Rio Grande empties into the Gulf of Mexico (Figure 1.9 and 1.10). Offstream channels in these two counties as well as Willacy County may be affected by future construction activities. The project area consists of 180 winding river miles. Features within the LRGFCP include 270 miles of levees, Retamal and Anzalduas dams, the Morillo Drain, and 500 irrigation and drain structures (USIBWC 2005 [website]).

International Tijuana River Flood Control Project Area

The International Tijuana River Flood Control Project Area (ITRFCP) consists of an approximately five-mile segment from the International Boundary to the Pacific Ocean, in San Diego County, California (Figure 1.11). The ITRFCP was completed in 1979. Specific proposed construction activities for this part of the project area were outlined within the scope of work. These activities are focused along a 2.3-mile segment of the Tijuana River, including construction of:

a) 1,223-foot long (0.23 mile) concrete channel,
b) 3,700-foot (0.70 mile) flared energy dissipater with grouted stone
c) 7,021-foot (1.33 mile) unlined low-flow channel;
d) 5287-foot (1.0 mile) levee on north side of channel;
e) 2,565-foot (0.49 mile) levee on the south side of the channel.

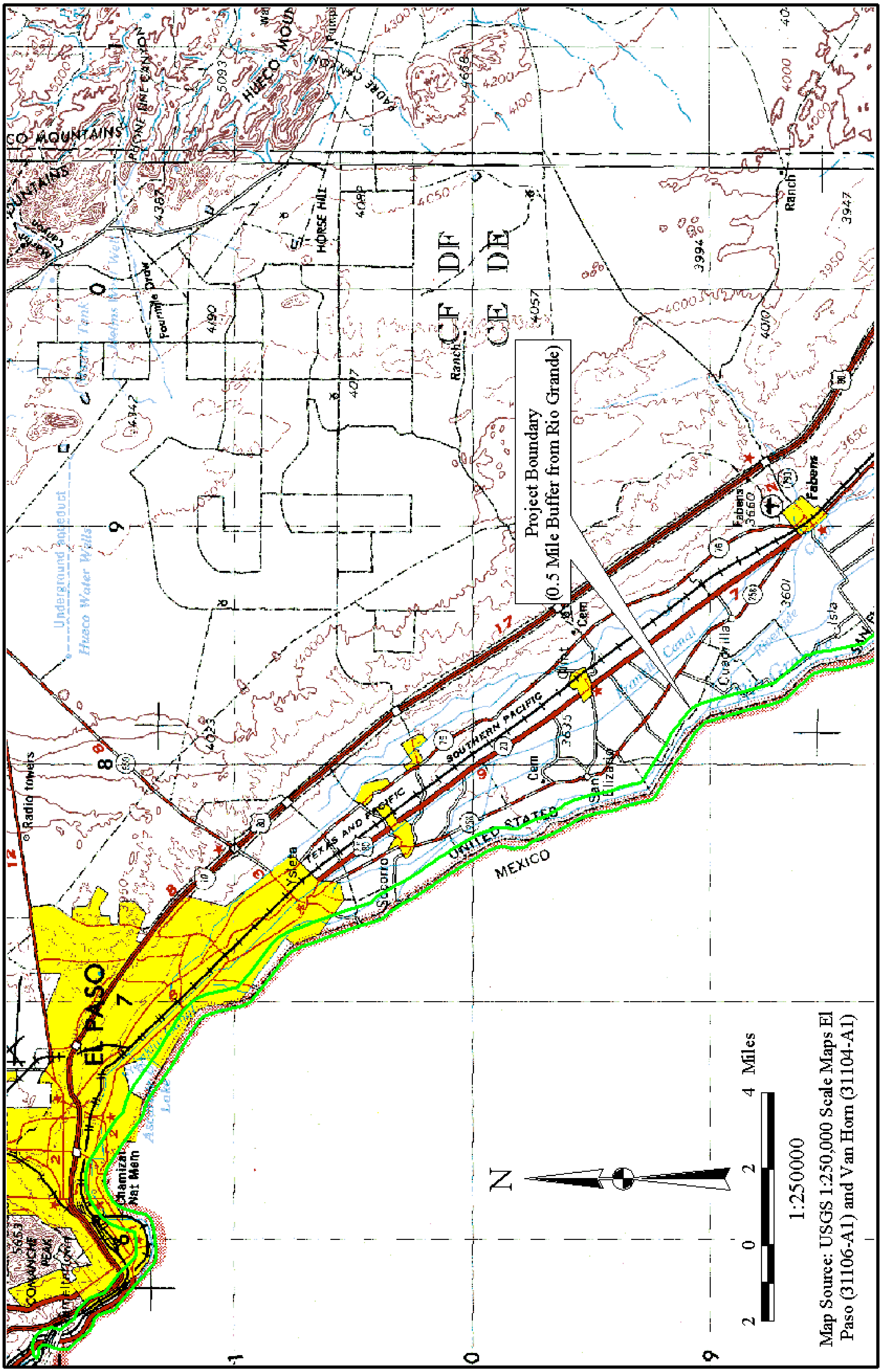

Figure 1.5. Project area map showing the northern portion of the Rio Grande Rectification Project Area.

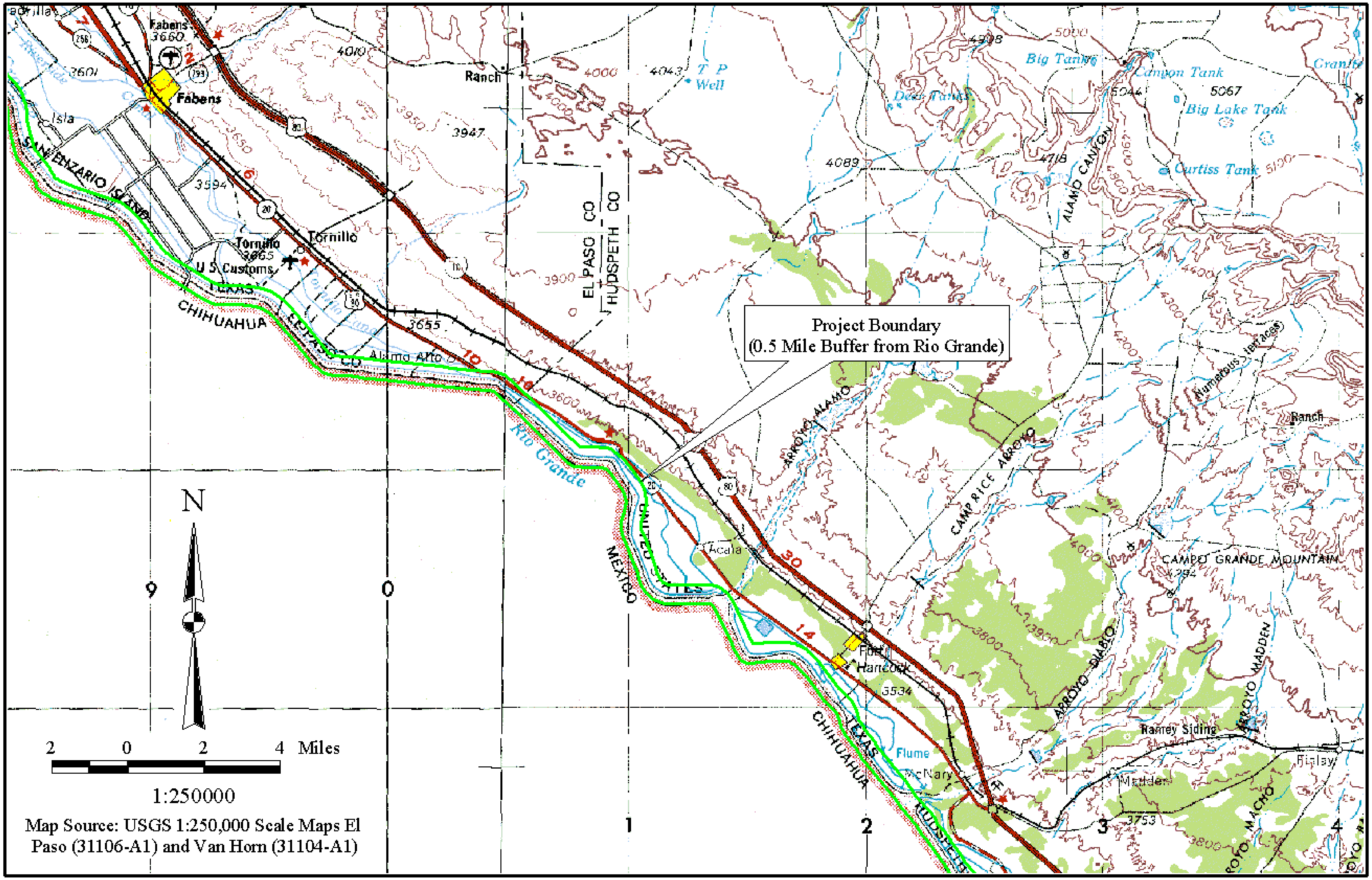

Figure 1.6. Project area map showing the central portion of the Rio Grande Rectification Project Area.

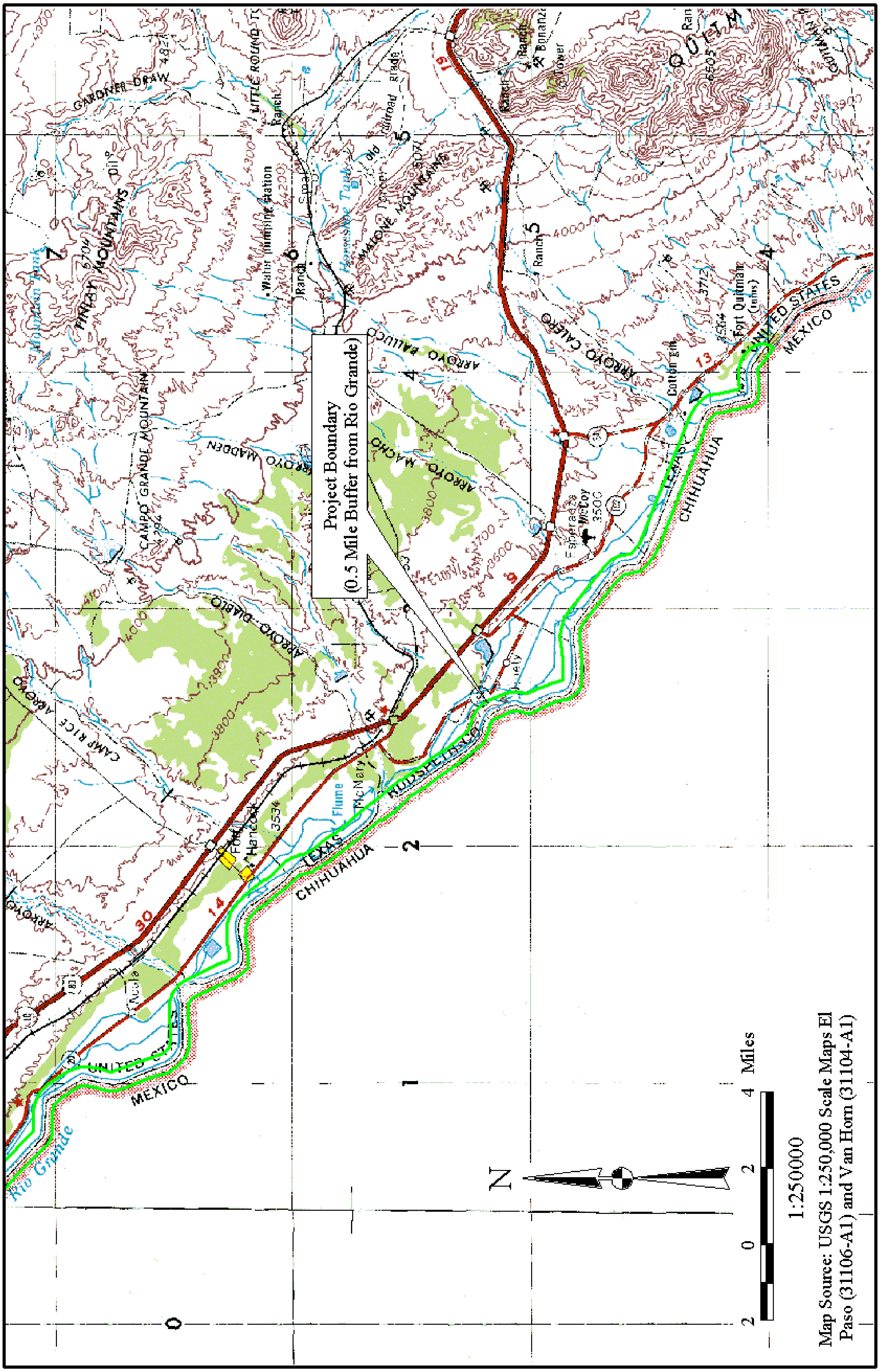

Figure 1.7. Project area map showing the southern portion of the Rio Grande Rectification Project Area.

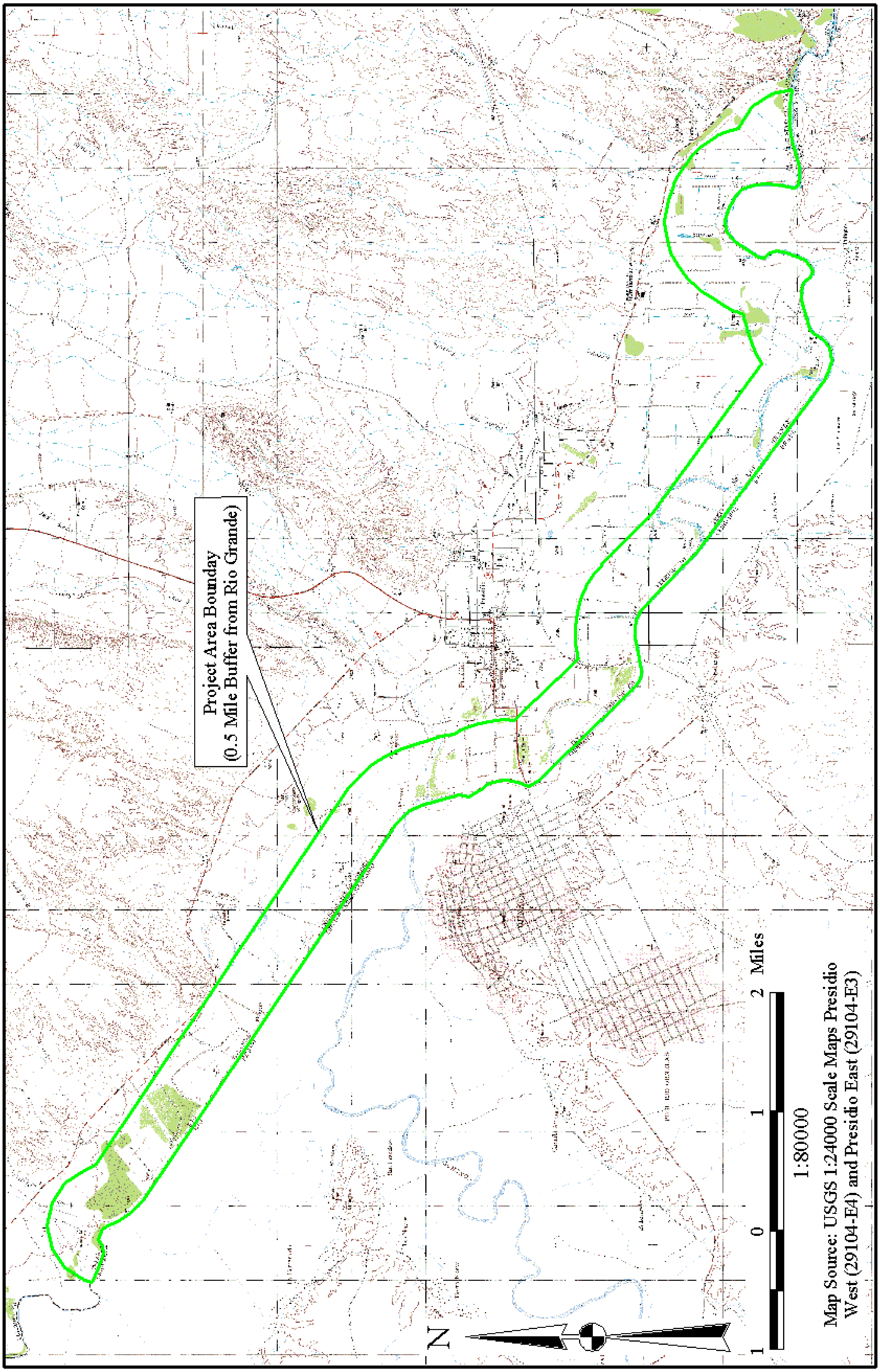

Figure 1.8. Project area map showing the Presidio-Ojinaga Flood Control Project Area.

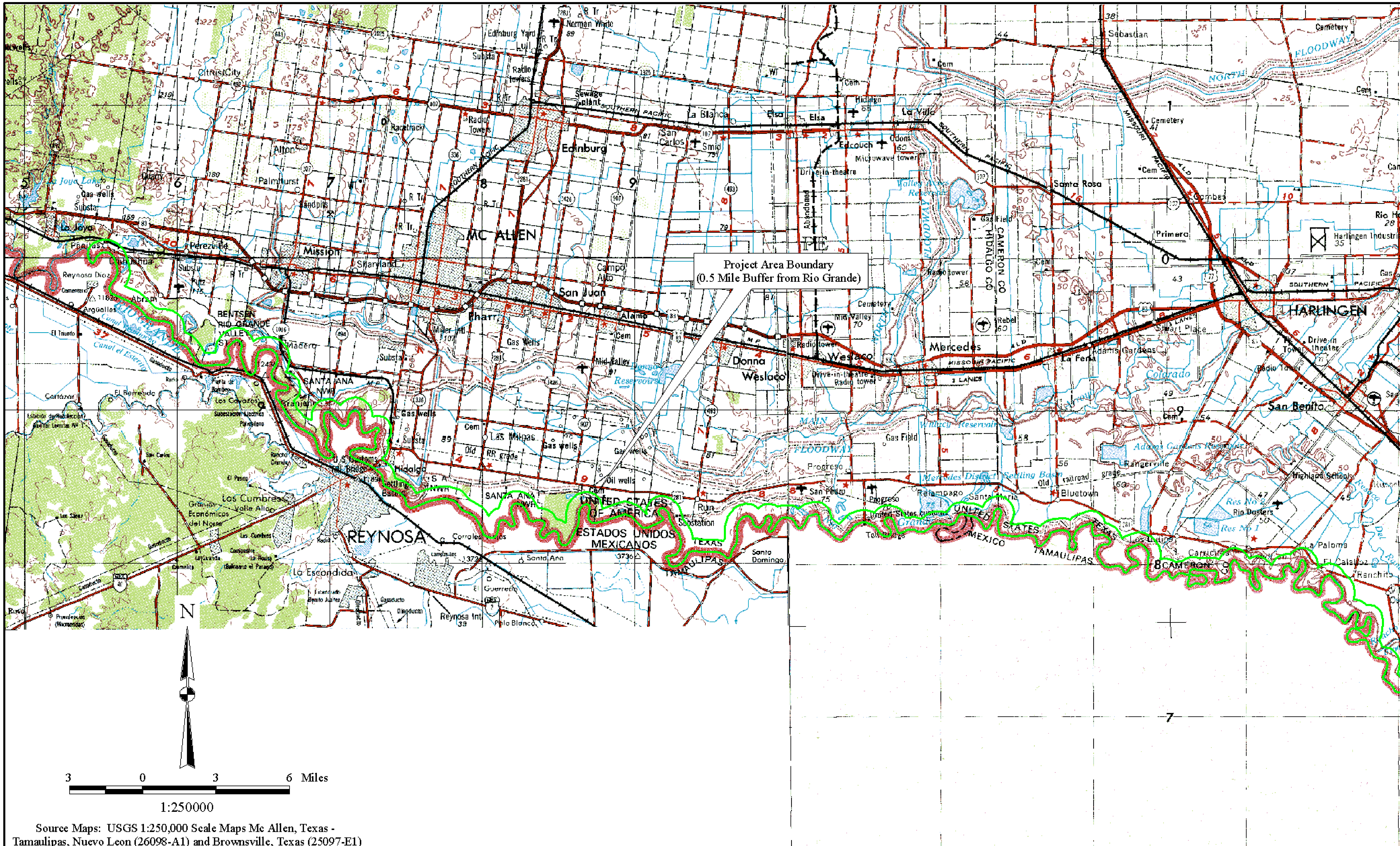

Figure 1.9. Project area map showing the northern portion of the Lower Rio Grande Flood Control Project Area.

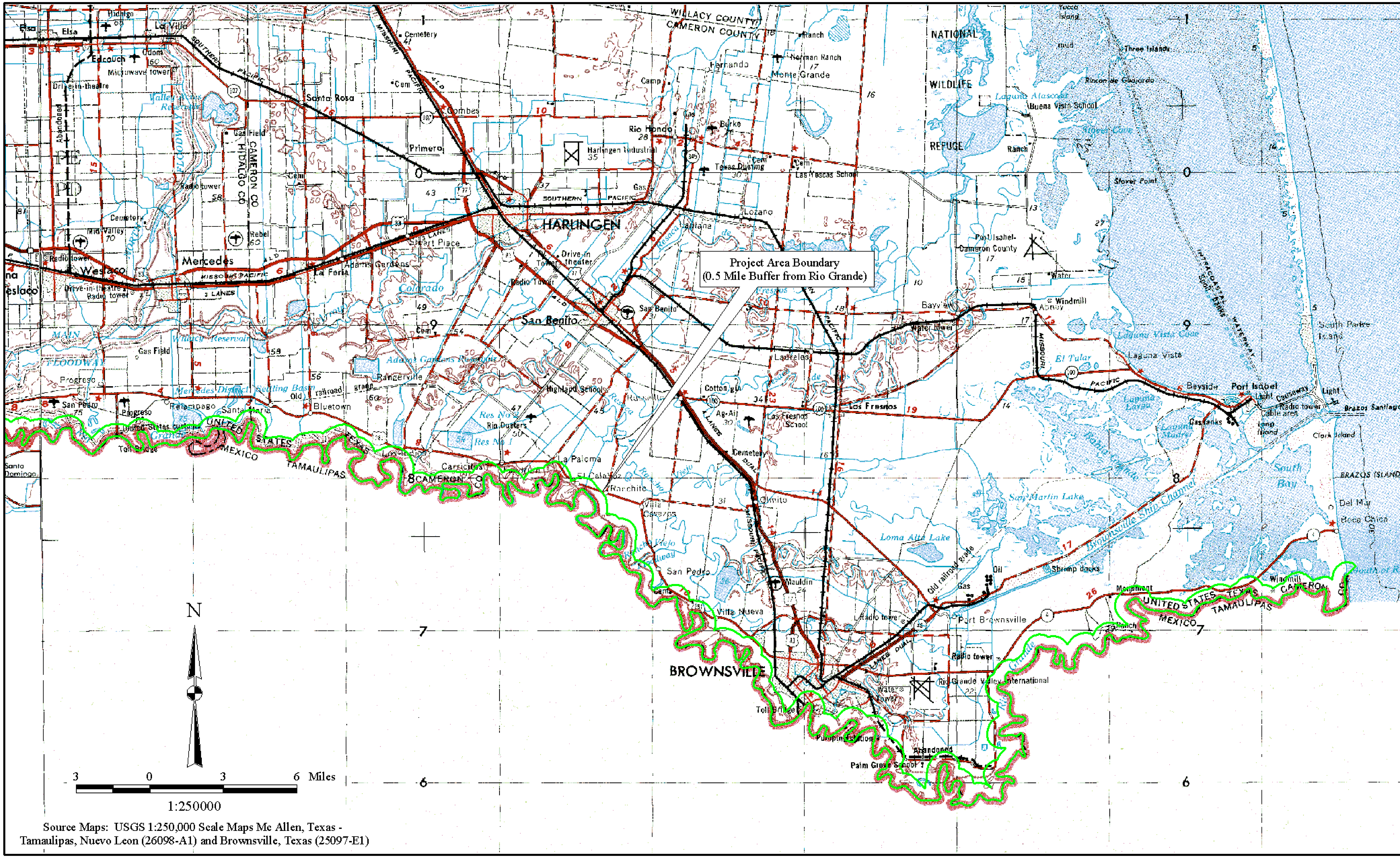

Figure 1.10. Project area map showing the northern portion of the Lower Rio Grande Flood Control Project Area.

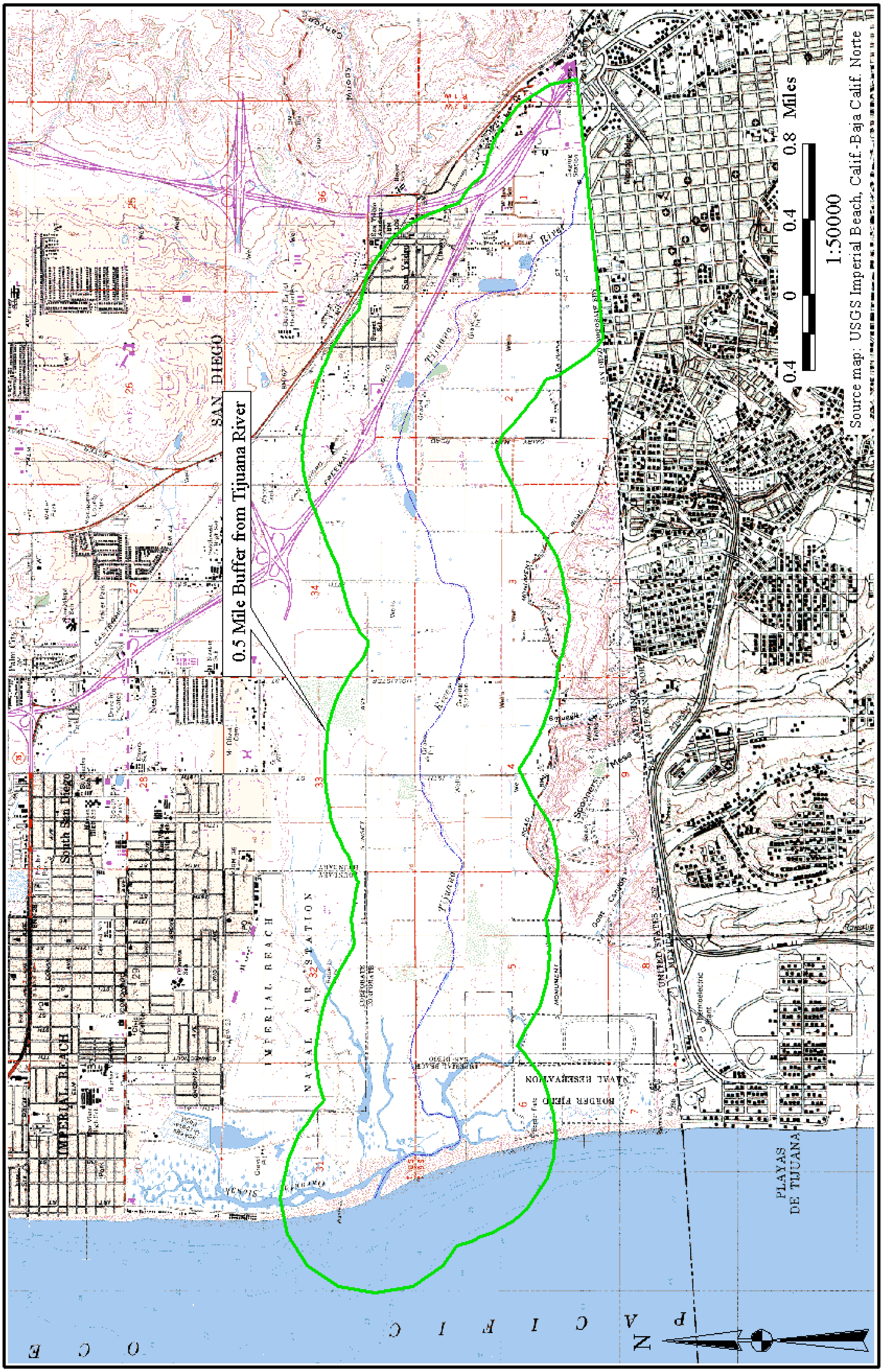

Figure 1.11. Project area map showing the International Tijuana River Flood Control Project Area.

CHAPTER 2
ENVIRONMENTAL SETTING

by

David D. Kuehn

This chapter summarizes the physiographic, geologic, climatic, and biotic settings of the five USIBWC project areas. The individual characteristics of the natural landscape are highly varied and are, in part, a product of the dynamic relationships that exist between climate, vegetation, and geomorphology. Geologic structural activity has also greatly influenced the physiographic and geomorphic development of large portions of the USIBWC areas.

PHYSIOGRAPHIC SETTING OF THE USIBWC PROJECT AREAS

The five USIBWC flood control projects are located in a variety of different physiographic regions. The Rio Grande Canalization Project (Percha Diversion Dam in New Mexico, to the American Diversion Dam in Texas), Rio Grande Rectification Project (American Diversion Dam to Fort Quitman, Texas), and the Presidio-Ojinaga Flood Control Project (Presidio County, Texas) areas are all located in the Basin and Range physiographic province (Muhs et al. 1987; Dohrenwend 1987), while the Lower Rio Grande Flood Control Project is situated in the West Gulf Coastal Plains physiographic province (Walker and Coleman 1987). The International Tijuana River Flood Control Project is located in the Tijuana River Basin and wave cut coastal plain portion of the Peninsular physiographic province.

The Basin and Range province covers a large portion of the western and southwestern United States (U.S.) and is characterized by parallel to sub-parallel-mountain ranges (horsts) separated by generally elongated basins (grabens). The Canalization, Rectification, and Presidio-Ojinaga Flood Control Projects are located within the Rio Grande Rift region, an area comprised of a series of asymmetrical grabens created by crustal extension and lithospheric thinning.

The West Gulf Coastal Plain physiographic province includes the western portion of the Gulf of Mexico coast and is characterized by sea-ward dipping layers of marine sediments (Cretaceous-Quaternary) overlain in places by fluvial/deltaic deposits, which are largely Quaternary in age (Walker and Coleman 1987:53). The Lower Rio Grande Flood Control Project area is situated within the Rio Grande flood and deltaic plain, an area comprised of sinuous stream channels and numerous abandoned drainage channels (resacas), meander scars, and oxbow lakes (bancos).

The Peninsular physiographic province is part of the Pacific Coast and Mountain geomorphic system (PCMS). The PCMS is characterized by coastal mountains and plains that front the Pacific Ocean from the U.S.-Mexico border through Alaska. The Peninsular province is located in the southern portion of the PCMS and includes the distal end of the Tijuana River basin, which is characterized by wave-dominated coastal plains and alluvial and estuary/marine-margin depositional environments.

GEOLOGIC CONTEXT OF THE USIBWC PROJECT AREAS

Rio Grande Canalization Project, Rio Grande Rectification Project, and Presidio-Ojinaga Flood Control Project Areas

The geology of the areas that encompass the Rio Grande Canalization Project, Rio Grande Rectification Project, and Presidio-Ojinaga Flood Control Project areas are inexorably tied to the geologic history of the Rio Grande Rift and Mexican Highlands portion of the Basin and Range province. The formation of the Basin and Range province began with the deformation of late Precambrian and Paleozoic continental margin strata during late Paleozoic to early Mesozoic orogenies. Deformation included two episodes of middle to late Cenozoic extensional faulting (Stewart 1978, 1980). Early detachment faulting began between circa (ca.) 30 and 35 Ma (million years ago) while the high-angle block faulting that is today a classic feature of the Basin and Range was initiated at ca. 17 Ma (Christiansen and McKee 1978; Dohrenwend 1987; Eaton 1982). In the Rio Grande Rift, this deformation continued in episode fashion to the present day (Dohrenwend 1987).

The tensional processes responsible for creation of the Rio Grande Rift resulted in a long, fairly narrow valley dominated by a series of north-south asymmetrical basins (Chapin and Cather 1994; Halley 1978). These basins are dominant features of the Rio Grande valley from southern Colorado downstream to near Presidio, Texas. There are four staggered, joined basins in the southern Colorado and New Mexico portions of the Rift. These are, from north to south, the San Luis Basin, The Espanola Basin, the Albuquerque (or Middle Rio Grande) Basin, and the Mesilla Basin.

South of the Albuquerque Basin, the rift valley broadens and is comprised of a series of angled mountain ranges and intervening basins. This portion of the Rift Valley is physiographically similar to the adjacent Basin and Range province but is differentiated by more active faulting during the Pliocene and Pleistocene, the presence of deep basins, and volcanic activity during the late Quaternary (Chapin and Cather 1994; Veach 1998).

In the New Mexico portion of the Rio Grande valley, surface geologic units include Quaternary alluvium and dune sand, the Tertiary and Quaternary Santa Fe Group (including the Camp Rice Formation), Quaternary basalt flows, Tertiary-aged volcanics (Rubio Peak and Palm Park Formations, Orejon andesite, and intermediate to silicic intrusions), and undivided Paleozoic (New Mexico Geological Society 1982; Figure 2.1, map color key is in Appendix B).

Quaternary alluvium is concentrated in the Rio Grande floodplain and on adjacent terraces and alluvial fans. The alluvium is comprised of largely unconsolidated gravels, sands, and muds of Pleistocene and Holocene age. In the Albuquerque Basin, Connell and Love (2001) describe six lithostratigraphic units within the Rio Grande valley that are inset against the Plio-Pleistocene deposits of the Santa Fe Group (which is ancestral Rio Grande valley fill). These units are, from oldest to youngest, the Lomatas Negras, Edith, Menaul, Los Duranes, Arenal, and Los Padillas Formations (Connell and Love 2001:J-67). Along the western edge of the Rio Grande valley, the surface of the Lomatas Negras Formation (or its temporal/lithological equivalent) is situated 65 to 75 m above the modern Rio Grande floodplain. The unit is comprised of moderately consolidated gravel (Connell and Love 2001:J-68). The Edith Formation is composed of upward-fining gravel, sand, and mud. The base of the 3-12 m thick unit lies ca. 12 to 24 m above the floodplain

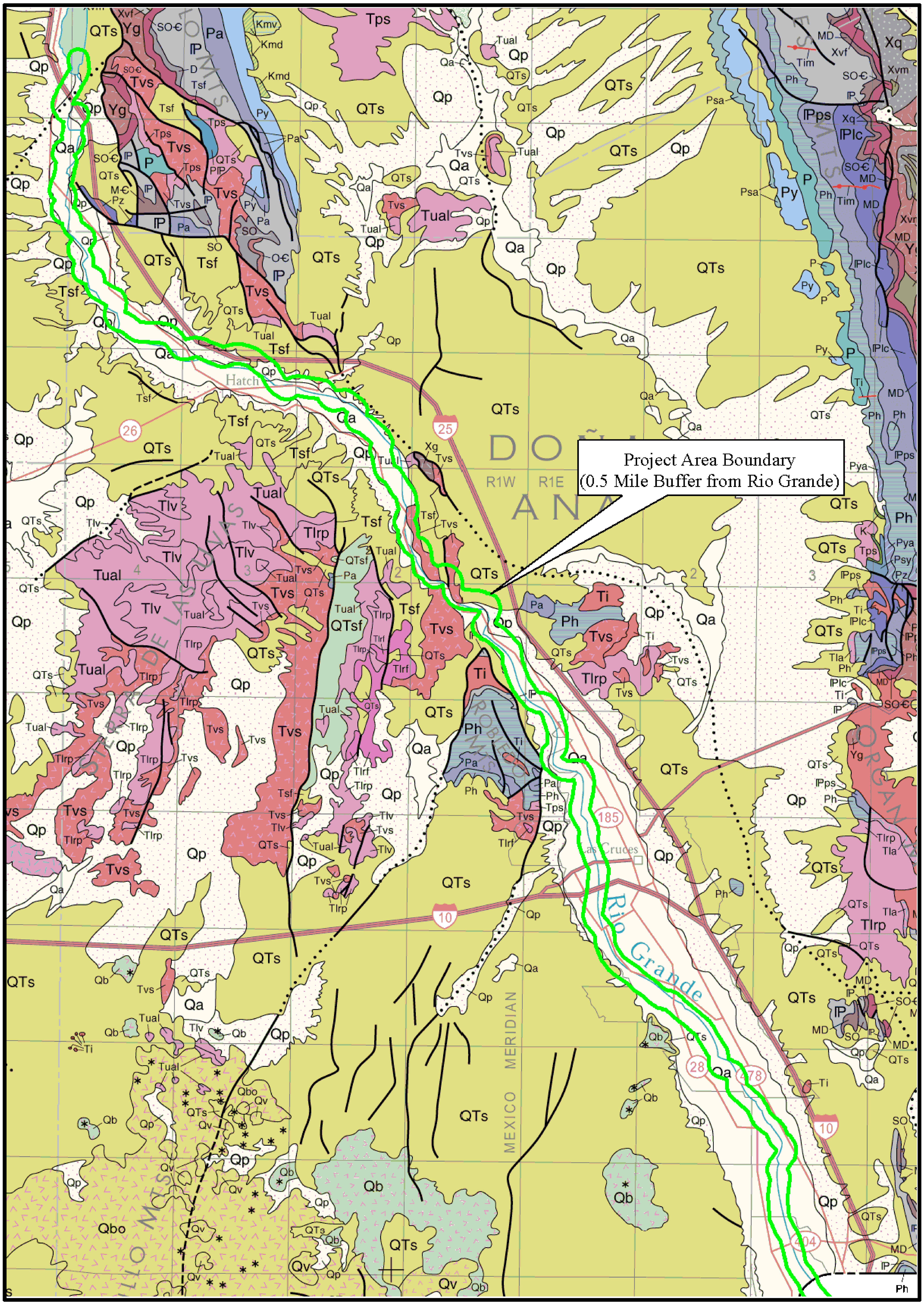

Figure 2.1. Surface geology map of the northern portion of the Rio Grande Canalization Project Area.

of the Rio Grande. The Los Duranes Formation was originally defined by Lambert (1968) and consists of 40-52 m of terrace fill in the form of reddish-brown to yellowish-brown sand, gravel, and sandy clay. The tread of the Los Duranes terrace lies about 42-48 m above the Rio Grande floodplain near Bernalillo, New Mexico (Connell and Love 2001). The Menaul and Arenal Formations are composed of gravel and gravelly sand and are located 26-36 and 15-21 m above the Rio Grande, respectively. The youngest fluvial unit described by Connell and Love (2001) is the Los Padillas Formation, which corresponds to the fill of the Rio Grande floodplain. The Los Padillas Formation (or its equivalents) is 15 to 24 m thick and consists of unconsolidated, pale brown sand, gravel, and interbedded, fine-grained sand, silt, and clay (Connell and Love 2001:J-73). The aggradation of the Los Padillas Formation began after the last glacial maximum, which occurred between ca. 15,000 and 22,000 years ago. Aggradation of the floodplain fill continued throughout the Holocene; however, most of the formation sediments were deposited prior to ca. 4500 years B.P. (Connell and Love 2001).

There are six structural basins along the Texas portion of the Rio Grande Rift. From north to south, these are the Mesilla Basin, the Hueco Bolson, the Salt Basin, the Eagle Basin, the Red Light Basin, and the Presidio Basin (Ryder 1996). A seventh basin, the Redford Bolson, is located south of Presidio, Texas and is considered a southern extension of the Presidio Basin.

Surface geologic units along the Texas portion of the Rio Grande Rift from American Dam to Fort Quitman are dominated by Quaternary-aged alluvium. These deposits include Qal (young Quaternary alluvium-Holocene), Qao (old Quaternary alluvium-Pleistocene), Qs (Quaternary sands), and Qtb (Quaternary-Tertiary Bolson Formation). Near the Rio Grande in the El Paso area, older rocks outcrop in the Franklin Mountains. These include Permian, Paleozoic, Ordovician, and Eocene deposits (Texas Bureau of Economic Geology 1992) (Figures 2.2 – 2.4; see Appendix B for map color key).

In the Presidio-Ojinaga Flood Control Project area, the Rio Grande has down cut through primarily Oligocene, but also Eocene-aged, volcanic rocks and conglomerates. These are labeled on the Geologic Map of Texas as OE, “Oligocene and Eocene undivided” (Texas Bureau of Economic Geology 1992). In the same immediate project area, the valley walls, according to the Emory Peak-Presidio Sheet of the Geologic Atlas of Texas, are comprised of the Oligocene Fresno Formation, a complex unit that includes volcanic breccias, tuffs, tuffaceous sandstone, and conglomerates (Barnes 1979, as summarized in Abbott 2001:109) (Figure 2.5; see Appendix B for map color key.

Lower Rio Grande Flood Control Project Area

The surface geology in the Lower Rio Grande Flood Control Project area is dominated by Quaternary-aged clays, silts, sands, and gravels that are primarily alluvial in origin, with lesser amounts of eolian, delta front, and near-shore deposits. Some of the latter types of sediments were originally deposited as alluvium that was later reworked by non-alluvial processes. The Quaternary deposits are unconformably underlain by Tertiary-aged marine sediments.

Bedrock geology in the Lower Rio Grande valley is characterized by late Cretaceous and Tertiary units that dip gently to the east-southeast. The oldest unit in the region is the Tertiary Goliad Formation (Pliocene), which has a thickness of ca. 180 m and is comprised of Pliocene sandstones, marls, and limestones associated with marine and marine-margin environments. The Pliocene sediments are fluvial-deltaic in origin. The oldest Pleistocene units are represented by the Lissie and Beaumont formations. The Lissie Formation consists of up to 120 m of fluvial sediments deposited by meandering channels of the ancestral Rio Grande. These sediments represent point bar, channel, oxbow lake, and backswamp depositional environments (Brown et al. 1980:47-54; Day et al. 1981:6). The Beaumont Formation units have a maximum thickness

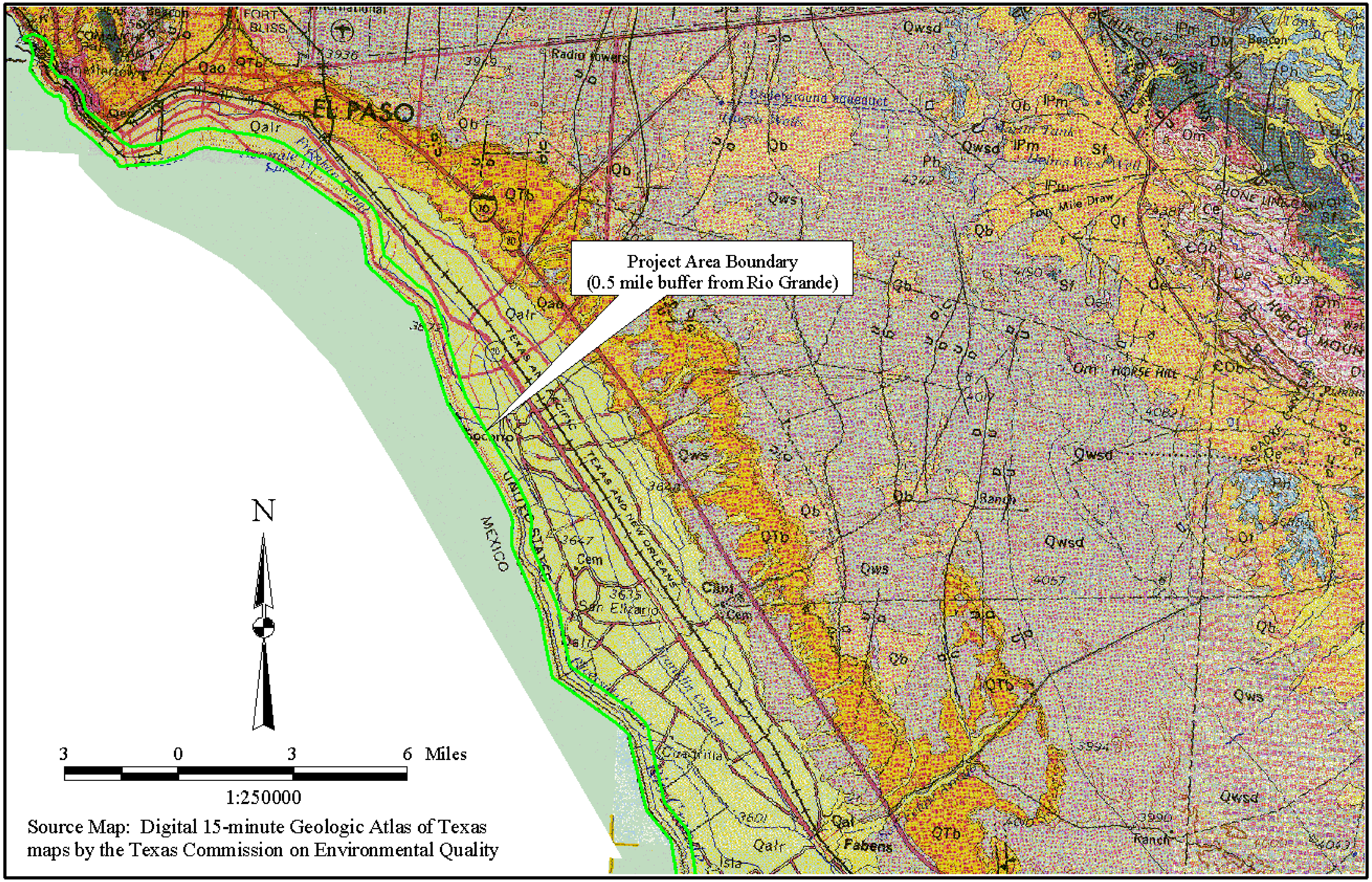

Figure 2.2. Surface geology map of the northern portion of the Rio Grande Rectification Project Area.

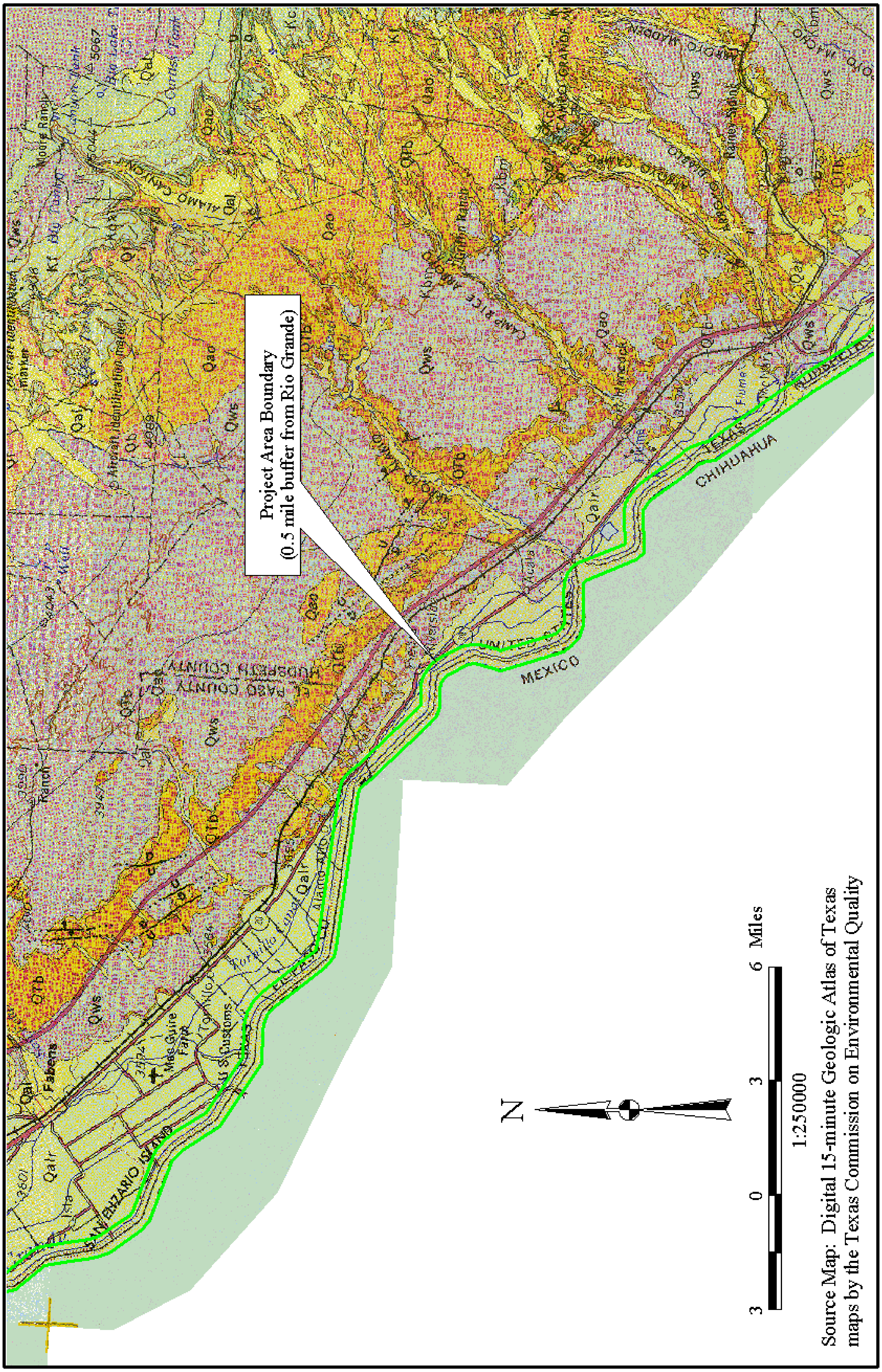

Figure 2.3. Surface geology map of the central portion of the Rio Grande Rectification Project Area.

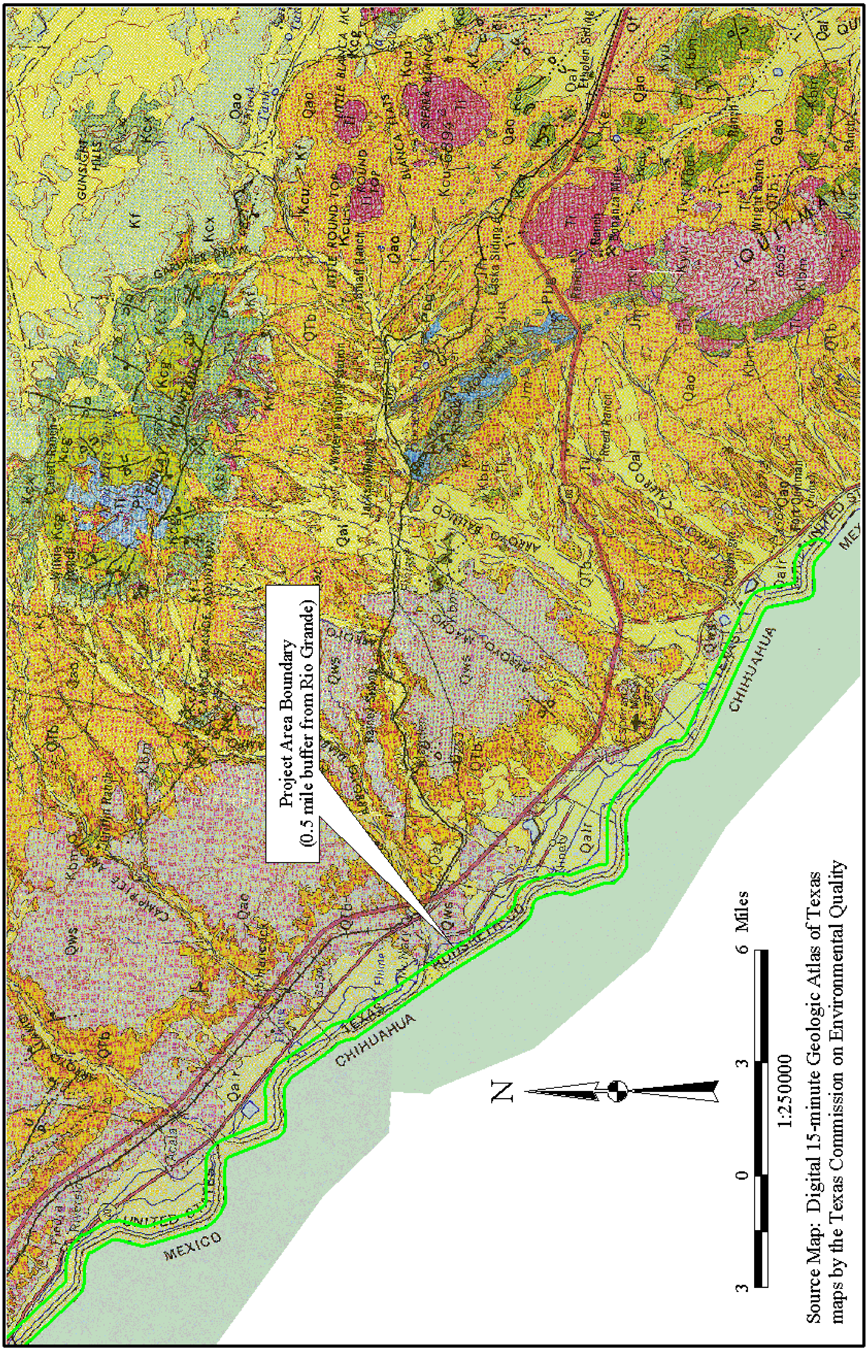

Figure 2.4. Surface geology map of the southern portion of the Rio Grande Rectification Project Area.

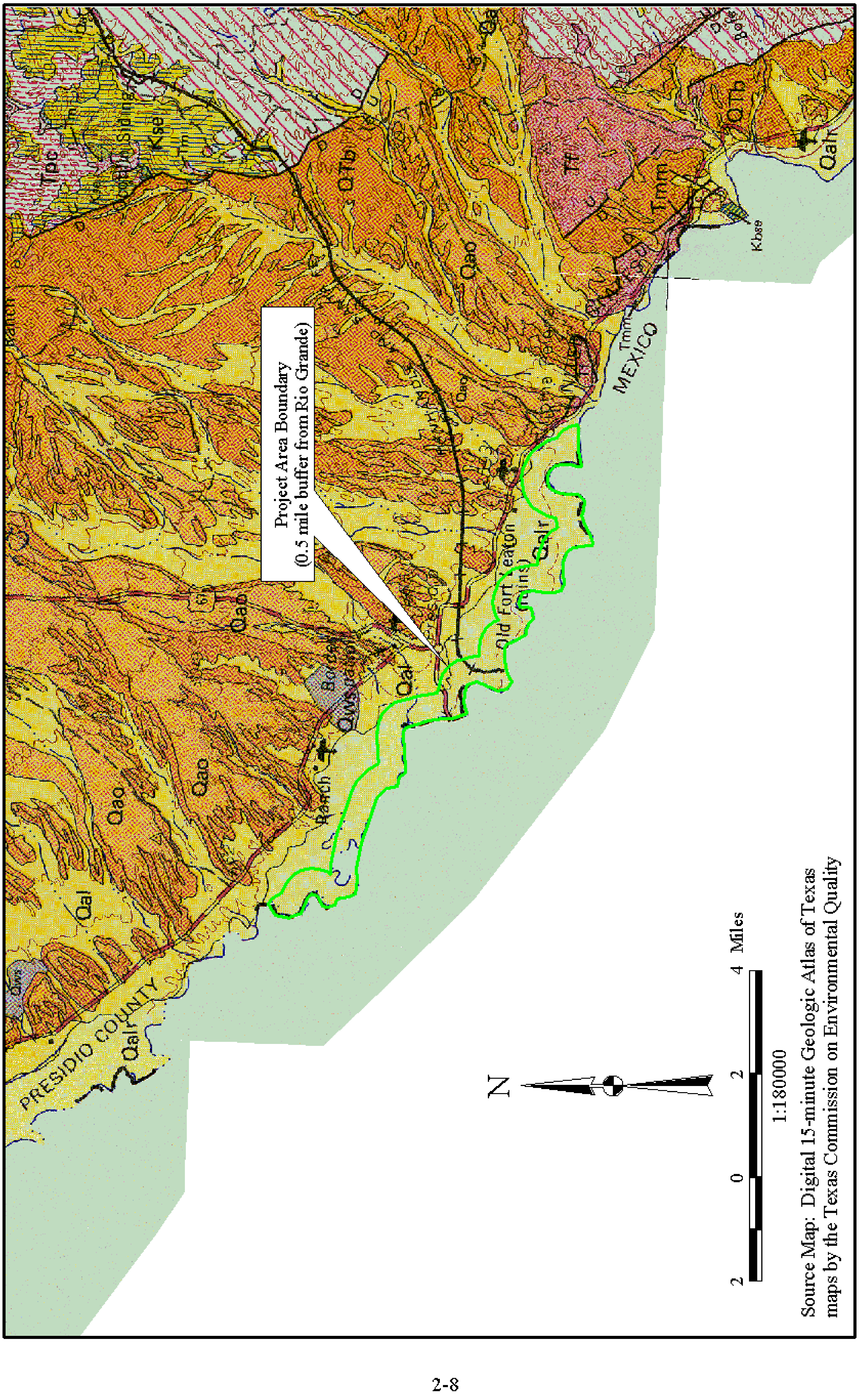

Figure 2.5. Surface geology map of the Presidio-Ojinaga Flood Control Project Area.

of ca. 275 m and outcrop over expansive areas north of the current Rio Grande floodplain. The lower Beaumont Formation consists of deltaic sediments arranged in stacked vertical sequences of distributary channel and levee sands, and interdistributary muds associated with seaward-extending lobes of the ancestral Rio Grande delta (Brown et al. 1980). The upper Beaumont Formation consists of Pleistocene fluvial-deltaic sediments deposited during Wisconsin interglacial episodes. These deposits are separated from the lower Beaumont units by an erosional unconformity and are termed Raymondville by Brown and others (1980).

International Tijuana River Flood Control Project Area

The 5.3-mile long ITRFCP area encompasses the Tijuana River Valley and Estuary in the Coastal Plains portion of the Peninsular Ranges province of southern California. The Peninsular Ranges province is characterized by a low-relief coastal plain, wave-cut marine terraces (mesas), and a series of elongate mountain ranges. The latter "formed when granites intruded into older metamorphics and sediments" (Moratto 1984:18). The "backbone" of the Peninsular Ranges consists of the Southern California batholith (Christenson 1990; Larsen 1954), a large mass of plutonic rock intruded into the older sediments (Jahns 1954). Elevations in some areas of the province approach 1,830 m (6,000 ft) above mean sea level (amsl).

The Coastal Plains portion of the Peninsular Range province is dominated by a series of fairly smooth marine terraces locally known as mesas. These mesas are composed of Pleistocene and Upper Pliocene marine deposits known as the Lindavista, Sweitzer, and San Diego formations (Biehler 1979) and are often dissected by steep-sided canyons and smaller drainages. The elevation of the mesas ranges from sea level to about 244 m (800 ft) amsl (Bowman 1973). Otay Mesa covers a large portion of southern San Diego County. It is bordered on the west by the Tijuana River valley, which flows from Mexico into the Pacific Ocean, and on the east by the foothills of the San Ysidro Mountains. A series of smaller mesa tops that lie primarily in Mexico extend north over the border on the western end of the project area, the largest of which is Spooner's Mesa. Spooner's Mesa is located approximately 1.45 km (0.9 mi) from the Pacific Ocean; Spooner's and Otay mesas are separated by the Tijuana River valley. Several major drainages bisect the mesa tops; Goat Canyon and Smuggler Gulch drain Spooner's Mesa from southeast to northwest, and Spring and Wruck canyons drain Otay Mesa from northeast to southwest; all drain into the Tijuana River valley.

Surface geologic units in the ITFLP area include recent (i.e., Late Quaternary) alluvium, slopewash, deltaic/estuary deposits, littoral beach sands, and sand dunes. Littoral sediments dominate the coastal portion of the project area, while alluvial deposits become dominate ca. 1.5 km east of the modern coast. Alluvial sandy soils flanking the Tijuana River channel have been termed the Tujunga sands (Butler/Roach 1988; Higgins et al. 1994a). Holocene deposits in the Tijuana River floodplain/estuary are ca. 30 m thick. These overlie, and/or are adjacent to sandstones and conglomerates of Pliocene to late Pleistocene age (U.S. Army Corps of Engineers 1989; Higgins et al. 1994a).

GEOMORPHIC SETTING OF THE USIBWC PROJECT AREAS

The geomorphology, or surface landform configuration, of the USIBWC project areas closely parallels their physiographic setting, again because of the direct relationship between climate, vegetation, and landforms (cf. Ritter 1978:18-21). Within the Rio Grande Rift Valley, the geologic/structural history of the region has directly influenced the geomorphology of the

USIBWC project areas, while in the Tijuana River and Lower Rio Grande valley, surface landform development has been shaped by a combination of fluvial and marine-margin processes.

Rio Grande Canalization Project, Rio Grande Rectification Project, and Presidio-Ojinaga Flood Control Project Areas

The Rio Grande is an extremely diverse perennial river that heads in the San Juan Mountains of south-central Colorado and from there, extends south through the central portion of New Mexico and the Rio Grande Rift, before trending south-southeast along the United States/Mexico border. The river eventually debouches into the Gulf of Mexico near Brownsville, Texas. With a length of approximately 3,200 km, and with elevations ranging from over 10,000 ft to sea level, the Rio Grande exhibits tremendous variability in local geomorphic conditions. In the Rift Valley region, the latter include channel sinuosity and hydraulic geometry, suspended and bedload competence, bank stability, and gradient adjustment (Schumm 1968; Schumm and Lichty 1965).

In narrow portions of the Rio Grande valley, the prehistoric channel of the Rio Grande followed a generally braided pattern; in broader portions of the valley, it assumed a sinuous, meandering pattern. While structure and bedrock controlled much of the geomorphic development of the confined portions, meandering and avulsion dominated the geomorphic processes in the broad valley portions. Other characteristics such as sediment load have also been heavily influenced by proximity to tributary streams. Finally, human modification of the Rio Grande floodplain has been dramatic and has resulted in significant alterations to the natural physiographic, geomorphic, and biotic landscape. These developments include dams and reservoirs, channelization, levee construction, channel stabilization and diversions. Cumulatively, the modifications have served to greatly reduce sediment yield to downstream portions of the river valley. This, in turn, has led to changes in geomorphic activity within the Rio Grande channel such as the number and movement of sand bars, altered thalweg positions, and migration of the channel across the valley floor (Tetra Tech 2004:13). In addition, reduction in activity within the channel leads to the stabilization of sandbars because frequent inundation does not remove anchoring vegetation. Processes such as this greatly influence the geomorphic characteristics of the river channel and adjacent floodplain.

Significant natural changes to the Rio Grande floodplain have occurred repeatedly during the Holocene due to stream meandering, flooding, and channel avulsion. One example of the diversity associated with adjustments to the Rio Grande channel was evident during an analysis of the fluvial activity over a 68-year period, between 1844 and 1912, in segments of the river through the Hueco Bolson and Mesilla Basin (Mack and Leeder 1998). According to a study conducted by the Bureau of Reclamation and other map sources from the period, the following channel and valley-bottom modifications were historically documented:(1) the width of the channel varied between 100-1,330 m; (2) sinuosity ranged from 1.2-1.9 (Schumm 1963); (3) portions of the channel migrated laterally over distances in excess of 1 or 2 km (in both straight and meandering segments); (4) a number of areas underwent sudden episodes of meander loop cutoff; and (5) different portions of the Mesilla Basin experienced at least three major episodes of channel avulsion (Mack and Leeder 1998).

Avulsion is a process involving the abandonment of a former river channel and the establishment of a new channel during high-energy flood events (cf. Walker and Cant 1984; Waters 1992). Geomorphic research indicates that portions of the Rio Grande floodplain are very prone to avulsion and indeed avulsion events are noted in historical accounts of the river's activity (Mack and Leeder 1998). Avulsion is initiated in five stages: (1) oxbow lakes are created through neck and chute cutoff of meander loops; (2) the lakes become filled with overbank muds, which form “clay plugs”; (3) the clay plugs are highly cohesive and resistant to erosion, which restricts the lateral migrations of the channel to a narrow, sandy meander belt; (4) channel, point bar, and levee deposition within the meander belts results in the construction of an alluvial ridge that rises above the level of the surrounding floodplain; (5) natural levees on this ridge are breached during a high energy flood event and runoff is funneled to the lowest portion of the floodplain, resulting in the establishment of a new channel and the abandonment of large portions of the former channel (Walker and Cant 1984; Waters 1992:137-138). As illustrated in Figure 2.6, avulsion-prone rivers leave numerous oxbow lakes and "clay plug" deposits.

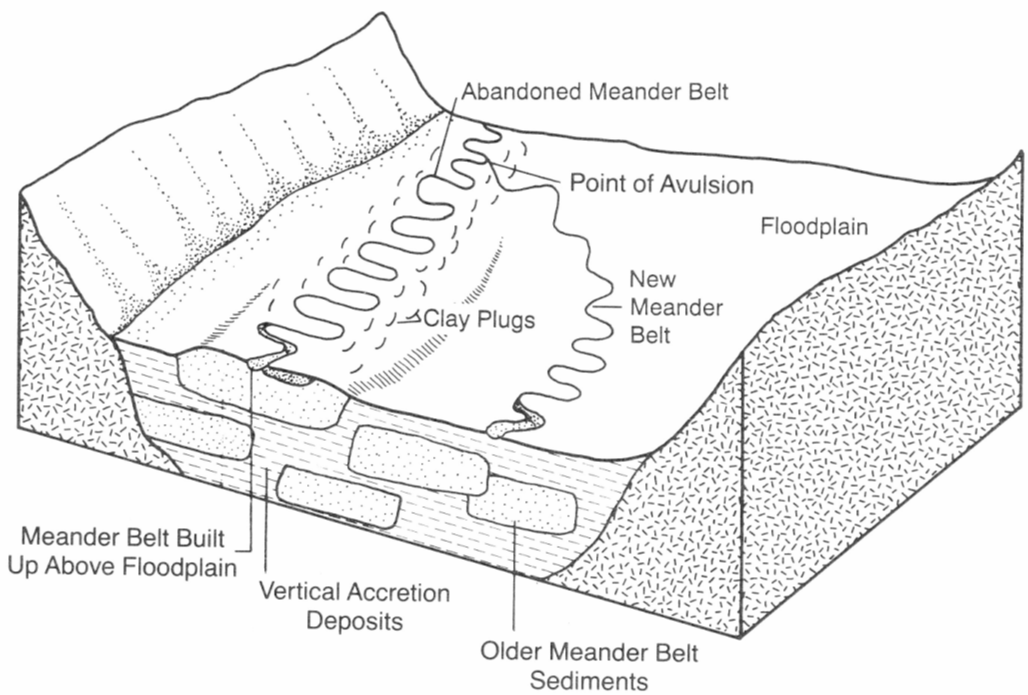

Figure 2.6. Schematic cross-section of channel avulsion in a meandering stream system (from Walker and Cant 1984, as modified by Waters 1992:137).

Because of research conducted in conjunction with the Desert Project, Gile and others. (1981) identified Pleistocene and Holocene deposits within the Rio Grande valley. These are termed the Tortugas, Picacho, and Fort Seldon units and include piedmont, alluvial fan, and terrace environments. The Fort Seldon unit is further subdivided into the Leasburg and Fillmore members, the former represent swath terrace and graded fan surfaces and date to ca. 9000 yr B.P. (Hawley 1965; Gile et al. 1981; Metcalf 1969).

As previously stated, Connell and Love (2001) have estimated that aggradation of the Rio Grande floodplain (termed the Los Padillas Formation) in the Albuquerque Basin occurred from the late Pleistocene through most of the Holocene. Radiocarbon dates from floodplain and adjacent alluvial fan deposits in the area from Percha Dam to south of El Paso were obtained and reported by Brown and others (2001), Frederick and Higgins (1993), Gallison and Wilcox (2001), and Hall (1994). The oldest dates out of the 11 reported by Brown and others (2001:102-104) were derived from Btbk soils in alluvial fan and arroyo mouth settings; these dates were 4850±70 yr

B.P. and 3070±60 yr B.P., respectively. The remaining samples, from Rio Grande sediments in the Rincon and lower Mesilla valleys, dated between 1090±60 and 260±60 yr B.P. (Brown et al. 2001:104). An additional 40 radiocarbon dates from the lower Rio Grande floodplain were reported by Frederick and Higgins (1993) and Hall (1994). These are summarized in Brown et al. (2001:105-107) and span the period from ca. 7300 to less than 100 yr B.P. The dated samples were recovered from primarily Rio Grande floodplain sediments and soils, but some were collected from adjacent, often interfingering, alluvial fan and arroyo sediments. While the range of ages reported from these samples is in keeping with the Late Pleistocene/Holocene age estimates for the equivalent Los Padillas Formation in the Albuquerque Basin, most of the dates were derived from bulk organic sediments. Bulk sediment dating has proven problematic by numerous researchers; with the problems associated with the inability to account for the source of organic carbon in soils (cf. Wang et al. 1996). These potential problems were addressed by Frederick and Higgins (1993), who argue that the soil humate ages may include older carbon stored in upstream alluvial fill, resulting in ages that are older than the actual episodes of valley aggradation. Brown and others (2001:108) on the other hand, argue that many of the humate ages are internally consistent and correspond well with temporal estimates provided by diagnostic archaeological materials.

This question is also addressed by Cooper and others (2003), who summarize geoarchaeological investigations conducted in the Lower Rio Grande Flood Control project area. The investigations centered on the excavation of backhoe trenches from floodplain localities located between Penitas and Brownsville, Texas. The description of soils and sediments within the backhoe trenches was augmented by the procurement of 10 radiocarbon ages, all of which were from soil humates. These dates ranged from 1460±30 yr B.P. to 2140±40 yr B.P., with the exception of one sample that yielded an age of 310±30 yr B.P. (Cooper et al. 2003). Despite apparent internal consistency in the soil humate ages, Cooper and others (2003:86-87) argue, like Frederick and Higgins (1993), that the dates are probably a reflection of the age of organic matter in the samples, rather than the actual age of sediment aggradation.

Most of the high terrace and alluvial fan surfaces bordering the Rio Grande floodplain are Pleistocene or older in age and therefore have the potential for palimpsest archaeological materials. In the Albuquerque Basin north of the Percha Dam area, Connell and Love (2001) associate these surfaces with the Lomatas Negras, Edith, Los Duranes, Menaul, and Arenal Formations, which are middle to late Pleistocene in age. As summarized above, in the Percha Dam to American Dam portion, analogous surfaces are associated with Tortugas, Picacho, and Fort Seldon units (Gile et al. 1981; see Figure 2.1). Similar Pleistocene terrace and/or alluvial fan units flank the Rio Grande floodplain in the American Dam to Fort Quitman and Presidio areas, where they are mapped as Qp, Quaternary alluvium - Pleistocene (Bureau of Economic Geology 1979; see Figures 2.2 - 2.5). On surfaces established prior to ca. 15,000 year ago, archaeological materials are not likely to be in deeply buried contexts. A lack of sediment aggradation in these areas makes it likely that materials from different time periods and from different named cultural groups will be mixed together with a general lack of original archaeological context (cf. Schiffer 1987; Waters 1992:96).

Lower Rio Grande Flood Control Project Area
(Lower Rio Grande Valley and West Gulf Coastal Plain)

During the late Pleistocene, the Lower Rio Grande valley witnessed a marine transgression associated with the last continental glacial advance. Deltaic and fluvial environments were replaced by brackish-water environments, near-shore environments, and later, open marine environments. By the beginning of the Holocene, as the rate of sea level rise began to slow and the level of sediment supply increased, the ancestral Rio Grande began to fill in the large estuary that had developed in the terminal Pleistocene. The river sediment prograded into the marine estuary, constructing three lobe-shaped deltas. As the river aggraded its valley and the delta plain widened and grew eastward, sandy fluvial meanderbelts and mud-rich floodbasins began to advance over the delta plain from the western edge of the valley. By the end of the mid-Holocene, the Rio Grande had refilled the valley it had carved in the late Pleistocene with clastic sediments of fluvial-deltaic origin. The front of the Rio Grande deltas at this point was several km east of the current coastline. In the late Holocene, however, as water and sediment supplies dropped, marine environments again began to advance over the eroding and subsiding edges of the Rio Grande deltas. This process of slow marine transgression continues today as Pleistocene and Holocene fluvial-deltaic deposits compact, subside, and are buried beneath the advancing marine muds and sands of Laguna Madre and Padre Island. Thus, although the Rio Grande continues to deposit and transport sediments and aggrade its valley in some areas, its current delta is in net retreat as compaction and subsidence outstrip deposition at the river's mouth.

Today the Lower Rio Grande valley/delta is characterized by a highly meandering main channel, numerous distributary channels, oxbow lakes and other meander-loop cutoff features, natural levees, lagoons, and barrier islands. As in the Tijuana section, man-made modifications to the Lower Rio Grande have been extensive and include channel adjustments, levee construction, bridge construction, and irrigation features.

International Tijuana River Flood Control Project Area

The geomorphology of the 5.3-mile long portion of the Tijuana River valley from the U.S.-Mexican border to the Pacific Ocean is characterized by a broad alluvial river valley bordered on the south and east by a series of mesas and canyons (former wave-cut marine terraces and intervening drainage channels), on the west by the Tijuana River Estuary and Pacific Ocean, and on the north by a structural basin and marine-margin environments that include San Diego Bay, spits, terrace islands, and sloughs.

The fluvial environment includes distributary channels, floodplain deposits, levees, and backswamp areas. The Tijuana River Estuary environment includes intertidal saltmarsh, sand/mudflats, tidal channels, and ponds.

Historic developments in the ITRFCP area have been extensive. These include agricultural modifications, gravel extraction, stormwater discharge, military features, and sewage oxidation ponds, discharge facilities and pipelines. Impacts to cultural resources have also resulted from natural disasters such as the floods of 1895 and 1916, which among other things destroyed the village of Millejo.

SOILS OF THE USIBWC PROJECT AREAS

Rio Grande Canalization Project and Rio Grande Rectification Project Areas

As summarized by Gibbs and others (2000) for the El Paso – Las Cruces Regional Sustainable Water Project, soils in the Rio Grande valley area are deep sands, loams, and clays that formed on alluvium, and are situated on flood plains and stream terraces. These types of soils may be associated with buried cultural materials. The most common soils are the Glendale and Harkey series, although numerous other types are also present and make for a complex soil mosaic. Most of the river valley soil types are deep, nearly level, and well drained. Glendale-series soils are common in depressed areas. The A horizon of Glendale-series soils is largely clay loam and ranges from zero to 12 inches in depth. There is no B-horizon in Glendale soils. The Glendale C horizon is moderately to highly stratified with four primary horizons, largely varying in color and clay content. The Harkey-series soils range from fine, sandy loam to clay loam in the A horizon and are zero to 20 inches in depth. The Harkey C horizon, extending to roughly 60 inches, contains less clay and is typically very fine, sandy to silt loam. The rock outcrop Torriorthents association occurs just north of Radium Springs, New Mexico, and extends for roughly seven miles. Each series of this association is well drained, but varies from shallow to deep and from hilly to extremely steep terrain. These soils form in alluvium and colluvium on mountains. Extrusions, escarpments, ledges, ridges, lava flows, and cliffs are all indicative of rock outcrop. Torriorthents association soils range from fine sand to cobbly and stony alluvium and colluvium (Bulloch and Neher 1980; Jaco 1971).

Presidio-Ojinaga Flood Control Project Area

Soils in the Presidio-Ojinaga Flood Control Project Area are dominated by six major soil types. These are: Anapra silty clay loam, Gila loam, Glendale silty clay loam, Harkey loam and silty clay loam, Saneli silty clay loam and silty clay, and Tigua silty clay (Natural Resources Conservation Service 2005). Anapra silty clay loam soils comprise very deep, well-drained floodplain soils, while Gila loam soils are deep, well-drained soils formed in mixed alluvium on floodplains or alluvial fans. Glendale silty clay loam soils are deep, well-drained soils formed in mixed alluvium on floodplains and low terraces. Harkey loam and silty clay loam soils are deep, well-drained soils that are associated with floodplains and low terraces. Finally, both Saneli and Tigua soils are very deep and moderately well drained soils located on nearly level to slightly depressed floodplains (Natural Resources Conservation Service 2005).

Lower Rio Grande Flood Control Project Area

As summarized by Cooper and others (2003), soils along the floodplain and delta of the Lower Rio Grande Valley include the Rio Grande series and the Matamoros series. The Rio Grande series consists of well-drained, calcareous silt loams (Jacobs 1981; Williams et al. 1977). The near-surface solum along the river consists of A-horizon material only. Neither of these series has well-developed B-horizons (Gustavson and Collins 1998; Jacobs 1981; Williams et al. 1977). These soils are termed Entisols, mainly due to the lack of horizon development and because primary sedimentary structures are still visible (Gustavson and Collins 1998:1, 12). The Matamoros series is associated with the bottomlands and overbank flood channels in the active flood plain, and consists of beds of calcareous clayey alluvium.

International Tijuana River Flood Control Project Area

There are 72 types of soils found within San Diego County; four main soils are concentrated in the Tijuana Estuary portion that encompasses the Tijuana River Flood Control Area. These four soils are Chino silt loam, Chino fine sandy loam, Tujunga sand, and Visalia sandy loam. The Visalia-Tujunga association consists of moderately well drained and excessively drained sandy loams and sands on alluvial plains, on 0 to 9 percent slopes (Bowman 1973; Buysse and Largent 1999).

Table 2.1.
Soil Types Potentially Occurring within the Tijuana River Project Area (after Bowman 1973)

Soil Series	Type	Slope	Parent Material
Chino	Silt loam, saline	0 to 2 percent	Granitic alluvium
Chino	Fine sandy loam	0 to 2 percent	Granitic alluvium
Visalia	Sandy loam	0 to 9 percent	Alluvial plains
Tujunga	Sand	0 to 5 percent	Granitic alluvium

CLIMATIC SETTING OF THE USIBWC PROJECT AREAS

The USIBWC project areas are predominantly located in the generally arid southwestern United States; however, rainfall, temperature, and other climatic aspects vary significantly between the two coastal portions (Pacific Coast and Gulf Coast) and the intervening Chihuahuan desert.

Rio Grande Canalization Project, Rio Grande Rectification Project, and Presidio-Ojinaga Flood Control Project Areas

The Rio Grande Canalization Project, Rio Grande Rectification Project, and Presidio-Ojinaga Flood Control project areas are all part of the Chihuahuan Desert climatic regime. The climate in the Chihuahuan Desert is arid subtropical, with abundant sunshine all year long. From 70 to 80 percent of the days throughout the year are sunny. During the fall months, the number of sunny days is reduced to about 76 percent. During an average year, 193 days will be clear; 99 partly cloudy; and 73 cloudy. Winters are characterized by fair, dry weather with mild days and cool nights. Although heavy snows (7 to 13 in) have occurred, snowfall is rare and is considered of little importance. Freezes occur during December and January. The lowest recorded temperatures were -7°, -2°, and 4° F at Van Horn, Alpine, and Presidio, respectively. Upper summer daytime temperatures range from warm (under 95° F) at Van Horn to over 100° F at Presidio. The average wind speed is 9 mph from the north, but strong winds from the west-southwest in the spring can average 11 mph. The average annual precipitation for this area ranges from 8 to 15 inches per year, with about 75 to 80 percent occurring from May through October. Very little precipitation occurs from February through April. Showers greater than 0.10 inches occur about once every 10 days during the summer, but irrigation is required to support plant life other than desert vegetation. Mean relative humidity ranges from about 45 percent in January to about 30 to 38 percent in April. Because of nighttime cooling, the daily relative humidity increases at night with maximum values of 40 percent occurring in early morning near sunrise and minimum values of 10 percent occurring in the early evening near sunset (Kingston 1991; National Fibers Information Center 1987).

Lower Rio Grande Flood Control Project Area

The project area falls within a biotic zone known as the Tamaulipan Province (Blair 1950). This large area covers the region south of a line from Del Rio to San Antonio and portions of northern Mexico. The Tamaulipan Province is considered an ecotonal area that is bordered on the west by the Chihuahuan Desert, on the east by the Gulf Coast deciduous forest, and on the north by the Balcones Biotic Province (Presley 2003:4).

The climate of the Tamaulipan Province is semi-arid, semi-tropical, and mega-thermal, the latter meaning there is a deficiency of moisture for plant growth and that some plant growth continues throughout the year. Brownsville, Texas has a mean annual temperature of 74° F and a mean annual precipitation rate of 25.5 inches. Most precipitation comes in the form of summer thunderstorms; however, late summer and fall tropical storms are not uncommon.

International Tijuana River Flood Control Project Area

The Tijuana River Flood Control project area has a subtropical, Mediterranean-type climate. Rainfall is heaviest during the period from November to April with little or no rain in summer. The average total precipitation on the Coastal Plain is 10 to 13 inches (Bowman 1973; Buysse and Largent 1999). Humidity is high on the Coastal Plain in summer because of fog along the coast. Moderate temperatures prevail, averaging between 31° and 88° F in winter to between 51° and 111° F in summer; the growing season, or the period between the last freezing temperature in spring and the first in fall, is 280 to 360 days (Bowman 1973). Winds are generally light (less than 8 mi per hour) 64 percent of the time. Wind directions vary, except for persistent westerly winds along the coast in the summer. Several times a year, pressure conditions cause a strong, gusty flow of air from the north or east; these Santa Ana winds are usually dry and at times unseasonably warm (Bowman 1973; Buysse and Largent 1999).

FLORA AND FAUNA OF THE USIBWC PROJECT AREAS

Rio Grande Canalization Project, Rio Grande Rectification Project, and Presidio-Ojinaga Flood Control Project Areas

As summarized in Gibbs et al. (2000), the broader portions of the Rio Grande floodplain largely consists of agricultural farmland. Crops grown within this area include primarily pecans, cotton, onions, cabbage, corn, chile pepper, and alfalfa. Soils consist of river clays and sandy loams. Along the edges of the valley, sandy soils exist within a poorly sorted gravel matrix.

Before farmlands predominated the land, thickets (bosques) of plants lined the river. These included cottonwood trees, mesquite, various shrubs and assorted grasses. Very few remnants of the bosques remain today due to river channelization, vegetation clearing, and vegetation control. Salt cedar tamarisk has replaced the indigenous plant life in the non-farmland areas.

High terraces and alluvial fans adjacent to the Rio Grande floodplain flank the piedmont zone of the Organ, Franklin, and San Andreas mountains in the area between Percha Diversion Dam in New Mexico and the city of El Paso, Texas (Gibbs et al. 2000). Vegetation within the upper slopes of this zone includes ocotillo (*Fouquieria splendens*), yucca (*Yucca elata*, and *Y. torreyi*), catclaw (*Acacia sp.*), creosotebush (*Larrea tridentata*), sotol (*Dasylirion sp.*), agave (*Agave lechuguilla*), cholla cactus (*Opuntia imbricata*), prickly pear cactus (*Opuntia phaeacantha*), Mormon tea (*Ephedra trifurca*), and remnant juniper trees (*Juniperus monosperma*). Shrubs such as littleleaf sumac (*Rhus microphylla*) occur in low frequency along the drainage cuts. Within the lower alluvial fans, soaptree yucca (*Yucca elata*), creosotebush, mesquite (*Prosopis glandulosa*), and grasses including blue grama (*Bouteloua gracilis*), fluff grass (*Erioneuron pulchellum*), purple three-awn (*Aristida purpurea var. wrightii*), broom snakeweed (*Gutierrezia sarothrae*), and mesa dropseed (*Sporobolus flexuosus*) become more prevalent (Gibbs et al. 2000).

In closed basins, like the Hueco Bolson, the vegetation community is composed of mesquite-stabilized sand dunes varying from 5 to 12 feet in height. Common plants in this area include mesquite, sandsage (*Artemisia filifolia*), soaptree yucca, creosotebush, four-wing saltbush (*Atriplex canescens*), blue grama, fluff grass, purple three-awn, mesa dropseed, and buffalo gourd (*Cucurbita foetidissima;* Gibbs et al. 2000).

Areas of undisturbed vegetation are characterized by grasslands, punctuated by zones of creosotebush. Vegetation in this area includes soaptree yucca, creosotebush, cholla cactus, and various grasses including blue grama and fluff grass.

Common bird species expected to occur within the study area include black-throated sparrow (*Amphispiza bilineata*), northern mockingbird (*Mimus polyglottos*), mourning dove (*Zenaida macroura*), and western kingbird (*Tyrannus verticalis*). Common raptors include red-tailed hawk (*B. jamaicensis*), turkey vulture (*Cathartes aura*), barn owl (*Tyto alba*), and burrowing owl (*Speotyto cunicularia*).

Mammals found within the project area can include Merriam's kangaroo rat (*Dipodomys merriami*), Ord's kangaroo rat (*D. ordii*), and deer mouse (*Peromyscus maniculatus*). Predators of these rodents are carnivorous mammals such as coyote (*Canis latrans*) and swift/kit fox (*Vulpes velox*). Mammals include desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), skunk (*Mephitis mephitis*), and coyote (*Canis latrans*). Deer (*Odocoileus virginianus* and *Odocoileus hemionus*) are found within mountainous portions of the study area (Gibbs et al. 2000).

Lower Rio Grande Flood Control Project Area

As stated previously, the Lower Rio Grande Valley is located in the Tamaulipan Biotic Province. Moving from west to southeast, the province consists of semiarid to subhumid brushland currently dominated by thorny brush (Black 1989). Blair (1950) noted that this large region was not homogenous and placed the extreme southern part of the Tamaulipan Province into the Matamoran District. This district includes a riparian zone that parallels the river and is more heavily vegetated than the other areas of the district (Mallouf et al. 1977; Cooper et al. 2003). In many areas, however, agricultural fields are now cleared up to, or near, the river edge, reducing this riparian zone in modern times. Boyd et al. (1994:7) state that an estimated 98 percent of the subtropical region of the delta has been cleared on the U.S. side of the river. Human impacts and management practices have drastically modified the flora and fauna during historic times. The largest contributors to recent modifications are clearing, planting, land modifications for agricultural purposes, overgrazing of range land, and the recent lack of grass fires that are thought to have controlled the spread of brush (Cooper et al. 2003; Black 1989; Boyd et al. 1994; Kibler 1994; Kibler and Freeman 1993). Modern vegetation noted during this project, excluding the large percentage of agricultural land, consists of black willow, Texas ebony, mesquite, acacia, salt cedar, hackberry, cattails/reeds, various grasses, cacti, some Mexican bald cypress, and numerous forbs and shrubs.

Blair (1950) states that the Tamaulipan Province has at least 61 species of mammals, numerous snakes and lizards, and two land turtles (Cooper et al. 2003). Historic and modern ranching and agricultural techniques, along with urban development, have undoubtedly affected the fauna of the lower Rio Grande. Changes to the biotic community are likely a combination of natural and humanly induced factors. By the latter 1800s or early 1900s, some species of once abundant wildlife such as bison, pronghorn antelope, bear, and wolf had been eliminated (Black 1989; Cooper et al. 2003). This can be attributed to over hunting and the rapidly changing biotic community. The only large native herbivore presently found along the Rio Grande today is the whitetail deer, which is quite rare in the river bottom (Roy Olivo, personal communication 1999, from Cooper et al. 2003). Currently, the future of the ocelot and jaguarondi is threatened by the continuing development within the Lower Rio Grande valley (Cooper et al. 2003).

International Tijuana River Flood Control Project Area

As summarized in Buysse and Largent (1999), vegetation communities within the project area have been extensively altered by agricultural and development activities, as well as by frequent fires; particularly on Otay Mesa and the eastern project area. The region is dominated by maritime communities on the western end of the project area, coastal sage scrub, and annual grassland along the slopes and upland areas, and riparian vegetation in the drainages of the canyons.

The intermingling of marine and fresh water in the Tijuana River Estuary directly north of the western half of the project area provides a range of environments depending on the degree of water salinity (Higgins et al. 1994a; Buysse and Largent 1999). This estuarine/wetland habitat supports such communities as maritime succulent scrub, southern coastal salt marsh, and freshwater marsh vegetation. Within the western project area itself, slopes and mesa tops are dominated by coastal sage scrub. Historic and modern activities in Goat Canyon and Smuggler Gulch, as well as on Spooner's Mesa, have disturbed much of the natural habitat; disturbances in the canyons have included the planting of eucalyptus and other ornamental vegetation, and agricultural activities on Spooner's Mesa have left a habitat dominated by grassland communities with remnant coastal sage scrub and eucalyptus trees acting as windbreaks. Plants observed in the western portion of the survey area include laurel sumac (*Rhus laurina*), peppertree (*Schinus* sp.), prickly pear (*Opuntia* sp.), sagebrush (*Artemisia californica*), tree tobacco (*Nicotiana glauca*), and willow (*Salix* sp.) and various grasses.

Much of the area from the San Ysidro Port of Entry to the east has experienced natural and/or human disturbances such as frequent fires that have shifted the once-dominant coastal sage scrub vegetation community to an annual grassland (Buysse and Largent 1999). Vegetation within this community is dominated by little barley (*Hordeum pusillum*), white-stem filaree (*Erodium moschatum*), peppergrass (*Lepidium* sp.), cheat grass (*Bromus tectorum*), Russian thistle (*Salsola tragus*), wild oat (*Avena fatua*), and prostrate yellow-cress (*Rorippa curvisiliqua*). Other vegetation includes ripgut grass (*Bromus diandrus*), Italian ryegrass (*Lolium perenne* var. *multiflorum*), goat-nut (*Simmondsia chinensis*), Parish's desert-thorn (*Lycium parishii*), chamise (*Adenostoma fasciculatum*), deerweed (*Lotus scoparius*), San Diego sunflower (*Viguiera lanciniata*), horehound (*Marrubium vulgare*), California burclover (*Medicago polymorpha*), and common sow thistle (*Sonchus oleraceu*) (Immigration and Naturalization Service [INS] 1999; Buysse and Largent 1999).

The riparian communities are primarily restricted to the nearly level floor of canyons, including Goat Canyon, Smuggler Gulch, and Spring Canyon within the project area. Two distinct riparian vegetation communities were observed within the project area—wetland herbaceous plants offering little canopy cover dominated by broad-leaved cattail (*Typha latifolia*), spiny rush (*Juncus acutus*), and California bulrush (*Scirpus californicus*), with some mule fat (*Baccharis salicifolia*), tamarisk (*Tamarix* sp.), castor-bean (*Ricinus communis*), and saltgrass (*Distichlis spicata*), and the less herbaceous vegetation with increased canopy cover and more shrubby plants dominated by arroyo willow (*Salix lasiolepis*) and mule fat with some giant reed (*Arundo donax*), castor-bean, tamarisk, and broad-leaved cattail (INS 1999; Buysse and Largent 1999).

Other than the riparian habitat in the bottom of drainages, the available habitat in the project area is of limited value to wildlife due to human disturbances and ongoing human activity. Bird species present in the area include the common raven (*Corvus corax*), phainopepla (*Phainopepla nitens*), black-chinned hummingbird (*Archilochus alexandri*), western kingbird (*Tyrannus verticalis*), mountain plover (*Charadrius montanus*), killdeer (*Charadrius vociferus*), American kestrel (*Falco sparverius*), turkey vulture (*Cathartes aura*), western meadowlark (*Sturnella neglecta*), red-tailed hawk (*Buteo jamaicensis*), rock dove (*Columba livia*), mourning dove (*Zenaida macroura*), scaled and Gambels quail (*Callipepla squamata* and *Callipepla gambelii*, respectively), wrentit (*Chamaea fasciata*), and California thrasher (*Toxostoma redivivum*). Mammal species that occur in the area include brush rabbit (*Sylvilagus bachmani*), black-tailed jack rabbit (*Lepus californicus*), California mouse (*Peromyscus californicus*), pocket mouse (*Perognathus longimembris*), brush mouse (*Peromyscus boylei*), nimble kangaroo rat (*Dipodomys agilis*), gray fox (*Urocyon cinereoargenteus*), and California ground squirrel (*Spermophilus beecheyi*). Reptilian species include gopher snake (*Pituophis melanoleucus*), common kingsnake (*Lampropeltis getulus*), and rattlesnakes (*Crotalus* sp.; INS 1999; Buysse and Largent 1999).

CHAPTER 3
CULTURAL OVERVIEW

by

Christine Ward, Victor Gibbs, and David Kuehn

In this chapter and the following one, we provide background to the data needs in our understanding of the past and the types of cultural remains that might be expected to be encountered along the Tijuana River and Rio Grande corridors within the project areas. The cultural overview in this chapter is divided into four archaeologically defined regions that include the five USIBWC Project Areas. Within each of the four culture region discussions, current understandings are presented temporally, beginning with first use of the region by peoples during the Paleo-Indian period and ending with Historic era use. While we try to focus these discussions on the river corridor, there are significant gaps in our knowledge of the use of the river's margins; as a result, we use data as well from areas outside the project area to provide adequate background. Specific chronologies, site types, and other information differ within each of the areas, though there is some overlap, and these differences are clarified in the following pages.

RIO GRANDE CANALIZATION AND RIO GRANDE RECTIFICATION PROJECT AREAS: JORNADA MOGOLLON REGION

The Jornada Mogollon Region, as generally defined (Lehmer 1948; Miller and Kenmotsu 2004), encompasses much of south-central New Mexico and the Trans-Pecos region of Texas. The boundaries of this culture region include all of the USIBWC Rio Grande Canalization and Rio Grande Rectification Project Areas. The chronology and culture history of the Jornada Mogollon region has been detailed by many researchers (Abbott et al. 1996; Beckes et al. 1977; Carmichael 1986; Gibbs et al. 2000; Miller and Kenmotsu 2004; O'Laughlin and Martin 1993; Peterson and Brown 1994; Vierra, et al. 1997a; Whalen 1977, 1978), from which the following discussions are summarized.

Evidence of human occupation in southern New Mexico and western Texas spans more than 12,000 years. The presence of human populations in the area is reflected by cultural remains dating from the Paleo-Indian, the Archaic, the Formative, the Precontact, the Protohistoric, and Historic periods (Table 3.1). A brief summary of these periods is presented here.

Table 3.1.
Jornada Mogollon Regional Chronology (from Miller and Kenmotsu 2004)

Period/Phase	Approximate Date
Paleo-Indian	Ca. 10,000-6,000 B.C.
Archaic	6,000 B.C.- A.D. 200
Early	6000-4,000 B.C.
Middle	4,000-1,200 B.C.
Late	1,200 B.C.-A.D. 200
Formative (Jornada Mogollon)	A.D. 200-1,450
Mesilla	A.D. 200-1,000
Doña Ana	A.D. 1,000-1,250
El Paso	A.D. 1,250-1,450
Precontact	A.D. 1450-1581
Protohistoric	A.D. 1581-1659
Historic	A.D. 1659-present

Paleo-Indian Period

Though little evidence is currently present for Paleo-Indian use within the two USIBWC project areas, it is probable that groups from this temporal period used the river's corridor and its many resources. During the Paleo-Indian period (ca. 10,000 B.C.-6000 B.C.), small bands of highly mobile hunters ranged widely and subsisted in part, at least, through the hunting of large, now-extinct species of megafauna including mammoth and bison (Gibbs et al. 2000). Stratified, intact Paleo-Indian period archaeological sites are uncommon in the Jornada Mogollon region; instead, the large lanceolate projectile points typical of the period are often found as isolated occurrences. Other material remains typical of Paleo-Indian populations include side scrapers, endscrapers, gravers, and drills. Sites associated with the Paleo-Indian period typically consist of lithic scatters and have been found in a variety of contexts. If diagnostic artifacts, such as the projectile points, are not present, identifying a lithic scatter as Paleo-Indian in age can be extremely difficult. In the southern Southwest, there is evidence to support a highly mobile lifestyle practiced by these populations. Lithic raw materials indicate that territories used by these populations may have been in the hundreds of kilometers (Miller and Kenmotsu 2004).

Based on changes in projectile point morphology, the Paleo-Indian period is divided into three subperiods or complexes: the Clovis, Folsom, and Plano (Irwin-Williams 1979). The changes in toolkit that characterize these sequential complexes resulted from slight modifications in their hunting and subsistence strategies (Miller and Kenmotsu 2004). Throughout the Paleo-Indian period, the environment gradually changed from a moist savanna to increasingly drier conditions, a situation that is thought to have had an adverse effect on large game populations. In response to declining herds, Paleo-Indian populations appear to have gradually adopted an increasingly generalized subsistence economy.

Archaic Period

The Archaic period represents a continuum of human occupation lasting some 5,000 to 6,000 years in the American Southwest. During this period, subsistence strategies gradually changed from the big game dependency common in the preceding Paleo-Indian period to a broad-based hunting and gathering adaptation, and settlement slowly changed to more limited, seasonal mobility (Miller and Kenmotsu 2004). The increasingly drier climatic conditions discussed in previous research (Irwin-Williams 1979; Van Devender 1977) are considered to have had a significant influence on the adaptation and distribution of human populations during the Archaic period. The broad-spectrum adaptation likely represents a response to environmental stresses that occur throughout the Southwest during this post-glacial period.

Archaic period occupations may be distinguished by the recognition of a variety of projectile point styles (stemmed, shouldered, and side- and corner-notched) that show significant change from the lanceolate points of the Paleo-Indian period. The toolkit also includes bifaces, flake scrapers, and drills. Archaic period sites typically consist of lithic and fire-cracked rock scatters that are often situated on mesa tops overlooking substantial arroyos or arroyo systems. Three sequential subdivisions within the Archaic period have been defined, based on morphological changes in projectile point types and a number of chronometric dates; these subperiods – the Early, Middle, and Late Archaic – have been discussed by Beckett and MacNeish (1987), Carmichael (1986), and Miller and Kenmotsu (2004).

Early Archaic Period

The Early Archaic period (approximately 6,000-4,300 B.C.) is poorly known throughout the Jornada Mogollon Region. Early Archaic period remains reflect an adaptation to a climatic shift to increasingly arid conditions. This transition is thought to have occurred throughout the Early Archaic period and appears to have significantly impacted both animal and human populations. According to Johnson and Holliday (1986:41), bison constituted the main protein source for inhabitants of the region during the Early Archaic period. Increasingly drier conditions led to the extinction of most large faunal species. Johnson (1983) suggests that the shift to a more generalized hunting and gathering subsistence strategy, particularly systematic plant use, was an adaptive response to nutritional stress created by changing climatic conditions.

Sites of this period are differentiated from the previous Paleo-Indian period by projectile point morphology. Early Archaic period projectile point types include straight-stemmed, concave base varieties (e.g., Bajada) or large, straight-based types (e.g., Jay). Sites consist of small thermal features and lithic scatters, and may be difficult to identify if diagnostic projectile points are absent. The most promising locations in the Texas Trans-Pecos region for finding intact Early Archaic period sites include rockshelters and alluvial fans (Miller and Kenmotsu 2004).

Middle Archaic Period

The Middle Archaic period (4,300-900 B.C.) is a time of shifting subsistence strategies. Data suggests that the climate fluctuated between extended periods of aridity, generally characteristic of the Altithermal, to relatively cool and moist conditions (Johnson and Holliday 1986). During dry periods, the subsistence strategy was similar to those from late in the Early Archaic period, (i.e., a generalized pattern of hunting and gathering with increased plant exploitation). During the intervening cool and moist periods, the emphasis of subsistence activities may have returned to bison hunting (Johnson and Holliday 1986:47).

During the Middle Archaic period, there appears to be a change from the manufacture of large, straight-stemmed projectile points, characteristic of the Early Archaic, to smaller or medium-sized, shouldered, and concave-based types (e.g., San Jose, Pedernales, Hanna). This change could reflect subsistence-driven technological changes, but more data are needed to provide evidence for this supposition (Gibbs et al. 2000). The blades of the projectile points are frequently modified, with serrated and beveled edges (Miller and Kenmotsu 2004).

Settlement pattern data could be used to suggest an increasing population; they could also simply represent a new seasonal mobility strategy (Miller and Kenmotsu 2004). There is a decrease in the number components in rockshelters, and an increase in open site locations, including both interior basins and along the Rio Grande. The latter are both on the upper and lower terraces of the river.

On the lowermost terrace of the river, and just outside the Rio Grande Canalization Project Area in northwest El Paso, is an important Middle Archaic period site, Keystone 33, at which evidence for the construction and occupation of structures was found (O'Laughlin 1980). These are some of the earliest structures found in the region though two other such sites have since been documented in the El Paso area, supporting the early dates for structures (Miller and Kenmotsu 2004). O'Laughlin (1980) identified 23 suspected pithouses at Keystone 33. They are shallow constructions, small in size, and made with a jacal superstructure; labor investment in their construction was low and they were likely just seasonally occupied (Miller and Kenmotsu 2004).

Late Archaic Period

The climate during the Late Archaic period (900 B.C.-A.D. 200) was similar to modern conditions. Material culture associated with the Late Archaic includes grinding stones, bifacial tools, and scrapers, as well as baskets, cordage, and snares. The diverse artifact assemblages evident during this time suggests a more intensive subsistence strategy, with an increased emphasis on small game and wild plants The Late Archaic period is also characterized by a substantial increase in medium-sized corner- and side-notched projectile point styles (e.g., Marcos, Williams, Shumla, and Ensor). These points resemble those associated with the Southern Plains of the Central Texas Archaic (Miller and Kenmotsu 2004; Rodgers 1987).

This period represents a true break from the otherwise gradual changes seen during the long Archaic sequence, and Miller and Kenmotsu (2004:226) suggest that the adaptations during this period have more in common with the ensuing Formative period than with the previous Archaic periods. There is an increase in sheer numbers of sites, and also an increased use of nearly all landforms, particularly rockshelters, the central basins, and alluvial fans. The recovery of aquatic species remains from some Late Archaic sites indicates that the river margins were definitely in use (Miller and Kenmotsu 2004). Site types range from lithic scatters to large pithouse villages, and include larger numbers of thermal features, many of which have been chronometrically dated.

The most noteworthy innovation during the Late Archaic period is the introduction of cultigens, as represented near the project area from Keystone Dam (O'Laughlin 1980). While the dates for the corn pollen from the site were indirect and relatively uncertain, dates on cultigens from elsewhere in the Jornada Region also indicate that cultigens were present in the area at this early date (Miller and Kenmotsu 2004). Throughout the Archaic sequence, there was an increasing use of plant foods, and the addition of cultigens may represent part of this long continuum; how this introduction is related to increased populations, uncertainties, or buffering strategies are as yet not understood.

Formative Period (A.D. 200-1450)

The Formative period (A.D. 200-1450) is defined by the introduction of ceramic technology. Early in this period, distinct ceramic and architectural traditions emerged. As defined by Lehmer (1948), the study areas lie within the Jornada Branch of the Mogollon culture region. The Jornada Branch, a desert-adapted expression within the larger Mogollon culture region, includes three phases: Mesilla, Doña Ana, and El Paso. While they are not beyond debate, the phases originally named by Lehmer (1948) are defined by changes in ceramic attributes, tradewares, and to some extent, structure types. The entire Formative period is one of increasing agricultural dependence, sedentism, and social integration (Miller and Kenmotsu 2004).

Mesilla Phase (A.D. 200-1000)

The beginning of the Mesilla phase corresponds with the production of plain, brownware pottery. The increased use of cultigens and the increased storage potential provided by ceramic vessels contributed to the inception of a more sedentary, village lifestyle; mobility, however, was still strongly present and the cultigens probably only played a minor role early on (Miller and Kenmotsu 2004). Structures are roof or ramp-entry circular pit structures. Decorated tradewares, predominantly Mimbres Black-on-white, are included in ceramic assemblages. Pinched and direct brownware rim forms are usually attributed to the Mesilla phase and are used for temporal assignments, particularly in the absence of decorated tradewares (Whalen 1978:59).

Settlement pattern data for the riverine environment are lacking for all of the Formative period, but Mesilla phase structures are known for areas along the river's margins (Miller and Kenmotsu 2004). These settlements generally consist of ephemeral 'huts', which required low energy expenditure to build; their remains are small in size (averaging around 2.5 m in diameter), and shallow (just 15-30 cm), lacking prepared floors and walls. This likely indicates that they were only seasonally occupied and that the residents still practiced a relatively high degree of mobility (Miller and Kenmotsu 2004).

While the layout of settlements in riverine setting is relatively unknown, there are data from elsewhere in the Jornada region to suggest what a village may have looked like. A centralized cluster of huts surrounded by discrete activity areas – including rock-lined pits adjacent to burned rock discard piles, and dense trash middens. The burned features may actually represent reuse of the settlement area after Mesilla phase abandonment (Miller and Kenmotsu 2004:242).

Doña Ana (Transitional) Phase (A.D. 1000-1250)

The Doña Ana phase (A.D. 1000-1250) encompasses the transition from pithouse to pueblo-style dwellings (Lehmer 1948:78), a change in local ceramics (e.g. a continuation of the El Paso plain brown plus the addition of bichrome and polychrome wares), and changes in tradewares (e.g., Chupadero Black-on-white and Three Rivers Red-on-terra cotta and black and red decoration combinations), thus indicating an increase in interaction networks with adjacent regions. This phase has been in contention because of its short temporal span. It may ultimately become accepted as a short-term transition along the continuum of increasing population, dependence upon agriculture, social integration, and cultural complexity (Whalen 1981).

Based on the presence of large numbers of open sites exhibiting ceramics relating to this time frame and well-developed roasting features, it is presumed that the continuation of horticultural and agricultural practices provided the subsistence base for large segments of the population. Few Transitional phase components have been identified in the river valley. Carmichael (1983, 1986) has noted that settlements dating to this time period tend to be located along medial and distal alluvial fans, at elevations above those dating to the ensuing El Paso phase (see discussion below).

Differences in settlement layout have been observed between early and late Transitional phase sites (Miller and Kenmotsu 2004). Early settlements tend to look very much like Mesilla phase settlements, discussed briefly above, while later ones have central clusters of pithouses surrounded by a variety of features, including hearths, and trash and other types of pit features; in other words, they consist of a greater use of outdoor space with the addition of more activity areas. Pithouses of the Transitional phase tend to be more substantial than Mesilla phase ones; they are deeper and have increased floor space, though they still appear to be somewhat informally constructed. Floor features also increase in occurrence; small hearths, postholes, and occasional storage pits are found, though the floors themselves are still unprepared. Formally constructed isolated rooms are also found that are relatively shallow and square in shape, with prepared adobe or caliche floors. Subfloor pits are somewhat more common than in the architectural form for this period.

El Paso Phase (A.D. 1250-1450)

The El Paso phase (A.D. 1250-1450) is the Pueblo period of Jornada Mogollon prehistory. This phase is broadly characterized by decreased settlement mobility, increased agricultural dependency, more restricted settlement distribution focused on well-watered landforms, and increased social and religious complexity (Miller and Kenmotsu 2004:238).

An increase in the size and density of habitation sites represents a population increase and corresponds with higher levels of social organization (Carmichael 1986:16). El Paso phase sites may be divided into settlement and special activity sites (O'Laughlin 1980). Habitation sites, occupied fairly permanently for unspecified lengths of time, tend to be located around playa and the river valley margins. Special activity sites, including hunting camps and plant gathering and processing areas, are larger than in the previous Formative period phases and seem to indicate fewer activities by larger task groups (O'Laughlin 1980:26). Both site types have been identified along the river and its margins.

Contiguous, surface room blocks of puddled adobe are the typical structural remains that are found (Sale and Laumbach 1989:140). Formally constructed isolated rooms and subrectangular pithouses continue to be constructed and used throughout this period as well (Miller and Kenmotsu 2004). The surface, contiguous room blocks consist of square to rectangular rooms, with formal, prepared caliche-plastered floors and walls. Floor and sub-floor features include central hearths, and storage and burial pits. These room blocks typically consist of 10 or fewer individual rooms. Among these is usually a single room larger than the rest; this room was likely for ceremonial, communal, or other special use by the room block inhabitants. Though exterior space excavation at these sites has been relatively rare, when conducted they have revealed and extensive array of exterior trash and storage pits, hearths, and other features. Isolated rooms and pithouses are similar to those constructed during earlier time periods.

El Paso Polychrome jars with everted rims are associated with this phase. A specialized, intensive farming adaptation has been suggested for the El Paso phase, although hunting and gathering continued to play a role in subsistence (Whalen 1978:38). Small mammals, particularly rabbits, are found in faunal assemblages of this phase (Carmichael 1986:16). Trade with surrounding regions reached its peak during this phase. This is suggested by the presence of ceramic tradewares from central New Mexico, as well as those from eastern Arizona and northern Mexico.

The end of the El Paso phase is marked by depopulation of the Jornada region; it may have reached lows not seen since the Middle Archaic period (Miller and Kenmotsu 2004). While it has been suggested that the local occupants may have dispersed to practice a less intensive hunter-gatherer lifestyle (Carmichael 1986), there is little archaeological evidence for occupation of the region after A.D. 1450. Production of the local ceramic types ended abruptly and most major village locations were abandoned by A.D. 1350 (Wimberly and Rogers 1977:450).

Precontact/Protohistoric Period (A.D. 1450-1581)

The Precontact period (A.D. 1450-1581) is defined as the relatively brief (approximately 130-year) span between the depopulation at the end of the Formative period and the first documented encounter between Native Americans and Spanish explorers. The archaeological evidence for this period is very slim; a few contexts have been dated to this span, but these are considered problematic (Miller and Kenmotsu 2004). Several Native American cultural groups may have used the project area during the Precontact period. According to Beckett and Corbett (1992), tribes including the Chinarra, Concho, Jano, Jocome, Manso, Suma, Piro, and Tarahumara may have occupied the local region.

The Protohistoric period (A.D. 1581-1659) represents the temporal span between the first European/Native American contact and the building of the first missions in the region. Many of the aboriginal groups inhabiting the region during the Precontact period may also have been present during the Protohistoric period, including the Suma and Manso in southern New Mexico and the El Paso region (Miller and Kenmotsu 2004; Vierra et al. 1997a). Early documents describe populations – identified specifically as Mansos – living along the river in small communities (Beckett and Corbett 1992). Residential buildings were made of straw, and thus archaeologically have been difficult to identify. The subsistence base for these populations, again according to documents, was primarily based on hunting of small animals and gathering of wild plant foods. Fishing was also mentioned in the texts. Archaeological evidence from the Protohistoric period is also slim, at best (Miller and Kenmotsu 2004). This could be due to the ephemeral nature of the residential structures and the difficulty in identifying them, but also could be due to natural site formation processes. Either way, this gap from the end of the Formative period until the first establishment of missions in the area is almost entirely unknown and represents a serious gap in our knowledge.

Historic Period

The date used for the onset of the Historic period (A.D. 1659) is based on the establishment of the first Spanish mission in the region. Many of the earliest Historic period events occurred very close to the Rio Grande, within or immediately adjacent to, the USIBWC project area.

Spanish Missions and the Pueblo Revolt

The first Spanish mission, as well as many activities associated with the earliest history throughout the area, is concentrated in the area of southeast El Paso and El Paso County in the Rio Grande Rectification Project Area. This mission, Nuestra Senora de Guadalupe de los Mansos, was established on the south side of the Rio Grande in what is now Juarez, Mexico. It was built specifically for the Mansos, but also to serve as a waystation along the Camino Real (Vierra et al. 1997a). Little is known about the original settlement that accompanied the mission, but much of it likely remains buried underneath the downtown Juarez area (Miller and Kenmotsu 2004).

When the Pueblo Revolt of 1680 occurred, thousands of Spanish colonists, as well as indigenous Piro and Tiwa, fled south from the middle and northern Rio Grande Valley in New Mexico to the El Paso region. More Tiwa came southward in 1682, and additional missions and communities were established in the El Paso region to accommodate these populations; all this construction occurred southeast of El Paso (Vierra et al. 1997a:28), very close to but likely outside the USIBWC Rio Grande Rectification Project Area, and included the settlements of San Lorenzo, Senecu, Ysleta, and Socorro. Near present-day Fabens, another mission was established for the Sumas (Brown et al. 1994).

Missions and other early settlements were located particularly in the river valley between Socorro and El Paso. Land grants were made, and estancias, ranchos, and haciendas were all established. The fertility of the Rio Grande floodplain lent itself well to its use for agricultural goods, including grapes, corn, beans, and wheat (Vierra et al. 1997a:33). Cattle were also raised, and oxen were kept for labor.

Spanish Rule

From 1692 until the end of Spanish rule in 1821, the El Paso area was largely a series of missions and Indian settlements under the control of Franciscan missionaries and Spanish officials (Hughes 1914). In the late 1700s, the presidio of San Elizario was moved to a location along the Camino Real; the San Elizario Historic District, which includes sites and localities (e.g. acequias, the plaza, mission, and a cemetery), lies within the USIBWC project area.

In 1821, Mexico won its independence from Spain, bringing the El Paso area under Mexican rule. The United States government established its boundary with Mexico after the Treaty of Guadalupe Hidalgo was signed in 1848 and the Gadsden Purchase was completed in 1853 (Harris and Sadler 1993). Following this event, the populations of Mesilla (established 1848), Las Cruces (established in 1849), and the El Paso area grew tremendously as transportation methods improved, first with wagon roads, and later with the development of the railroads (Staski 1984; Marshall and Versluis 2000). A road that lead from Corpus Christi to California – allowing for travel for the California '49 gold rush – paralleled the Rio Grande beginning near present-day San Elizario (Brown et al. 1994:54). The presidio there was abandoned around the same time.

To protect the area from Apache attacks, an American military presence was established in the El Paso area in 1849, with Fort Bliss being formally established in 1854. After several abandonments and reoccupations of the original fort, located in the project area near the American Dam, the post was moved and permanently established on the eastern foothills of the Franklin Mountains in 1893, prompted by inadequate site locations and the onset of the Civil War (Harris and Sadler 1993). Other forts, including Fort Thorn (1853-1859), Fort Fillmore (1851-1862; Staski 1995) and Fort Selden, (1865-1891; Staski 1995), Fort Hancock (1882-1895; Kohout 2005), and Fort Quitman (1858-1861, 1868-1877, 1880-1882; Dinges 2005) were established to help protect travelers along the Rio Grande.

American Rule

With the arrival of farmers in the American west in the mid-1800s, a stable water source was needed to support the growing population. Western farmers learned that the desert's prehistoric inhabitants relied on irrigation and water management techniques to yield successful crops year after year. An effective method of water management and control had to be implemented for a large sedentary population to be sustained in this arid land (Gibbs et al. 2000).

In southern New Mexico and in the valley around El Paso, most early farms and settlements were situated near perennial streams or rivers; however, seasonal depletion of the stream flows often stunted their crops. In most small towns and villages, the use of an acequia (an irrigation ditch or canal) that diverted water from a stable source (such as the Rio Grande), often met the water needs for the entire community (Brown et al. 1994; Gibbs et al. 2000). Canals were dug for irrigation across the San Elizario, Socorro, and Ysleta areas throughout the early 1850s; many of these early canals, laterals, and even earlier acequias are still part of the lower valley landscape

(Brown et al. 1994), and several lie within the bounds of the USIBWC project area. As the population in southern New Mexico and western Trans-Pecos region of Texas continued to grow at the turn of the century, a more aggressive water management plan had to be developed.

A series of destructive floods in the late 1800s and early 1900s impacted the communities in the Las Cruces and El Paso areas, and brought about serious changes to the acequia and channel systems. The historic Franklin Canal was built leading from El Paso south through the lower valley; this, too lies within the USIBWC project area, representing some of these historic efforts to control the river (Brown et al. 1994:55). These floods were the catalysts for the creation of several private companies to develop and manage irrigation systems. The governing bodies of New Mexico, Texas, and Mexico concurred that a reservoir was needed, but the location of the storage facility was the primary point of contention (Lester 1977:39). In January 1897, the Rio Grande Dam and Irrigation Company started construction on the first diversion dam at the head of the Mesilla Valley, elephant Butte (Lester 1977:51).

San Elizario became the seat for local government in the El Paso area and, as a result, the population expanded rapidly in its vicinity in the middle part of the 1800s. In the early to mid-1870s, land purchasing in the valley was active and by the 1880s, the railroad had been built through the region, to the north of the project area. This diverted populations away from the lower valley and away from these original settlements (Brown et al. 1994).

As the El Paso and Lower Valley areas continued to grow through the latter part of the 1800s and the first half of the 1900s, numerous developments and alterations were made within the USIBWC project areas through the region. Homes, businesses, theaters, a post office, the courthouse, and the train station, among others – many of which are on or eligible for the NRHP – were built very close to or on the floodplain of the river.

International Boundary and Water Commission

The conclusion of the Mexican-American War and the 1848 Treaty of Guadalupe Hidalgo established the Rio Grande as a permanent boundary between the United States and the Republic of Mexico. However, difficulties soon arose with this division because of sudden river channel changes during floods, thus repeatedly altering the international borders between the two countries (Bowman 1955:39). The meandering of the river provoked drafting a series of treaties and the formation of several temporary commissions. Eventually, the International Boundary and Water Commission (IBWC) was established to manage the boundary and the river.

Between 1854 and 1855, a temporary commission headed by Major W. H. Emory, was established to survey the line dividing the two countries (Bowman 1955:37). As stated in Emory's report, an International Boundary Commission, composed of one commissioner and one consulting engineer from each country, would exercise exclusive jurisdiction over problems arising from changes in the bed of the river and from the construction of structures that would affect the boundary. This commission was formed by treaty in 1888; early in 1889, the treaty was ratified.

On January 8, 1894, the International Boundary Commission was formally organized in the office of the Mexican consul at El Paso (Clark 1987:90). In order to manage the boundary more efficiently, it was divided into three sections. The first section ranged from El Paso to Presidio del Norte. This was the most problematic section due to the strong currents and firm soils that formed the riverbed; the rivers path often meandered and created entirely new channels leaving the old path visible, which feasibly could be mistaken for the international boundary. Second, a section from Presidio to Rio Grande city which was composed of bedrock and firm riverbed materials, and lastly the section from Rio Grande City to the Gulf of Mexico, which constantly shifted from erosion and frequently by avulsive changes, leaving many segregated tracts or bancos (Bowman 1955:49).

PRESIDIO-OJINAGA FLOOD CONTROL PROJECT AREA: EASTERN TRANS-PECOS REGION

The Trans-Pecos Region of Texas is typically separated for archaeological discussion into eastern and western segments (e.g. Mallouf 1985; Miller and Kenmotsu 2004). The Presidio-Ojinaga Flood Control Project Area falls within the eastern segment. The culture history of the eastern Trans-Pecos Region largely parallels that of the Jornada Region from the Paleo-Indian through Middle Archaic periods (Table 3.2). To date, however, no components dating to these periods have been identified in riverine settings in the eastern Trans-Pecos region; for a general overview of the trends represented during these earlier time periods, see the discussions above for the Jornada Region. The following overview begins with the Late Archaic period. The following discussion is primarily summarized from Cloud (2004), Mallouf (1985), Miller and Kenmotsu (2004), and Sale and Gibbs (1998), but other references are used, as noted.

Late Archaic Period (1,000 B.C.-A.D. 900)

Although the whole of the Archaic period may be seen as a continuum of increasing populations and decreasing mobility, this period is represented by a number of innovations that truly sets it off from the earlier periods. The ending date for this period is well dated, and falls several centuries later than in the Jornada Region to the west (Miller and Kenmotsu 2004). There is also a notable divergence in projectile point forms, and an intensification of plant processing (Cloud 2004). There is a dramatic increase in the numbers of sites from the earlier Middle Archaic period. In addition, these sites can be found in almost all ecological settings – river terraces, high mountains, inter-mountain bolsons, and near springs.

There are a number of projectile point types that are of distinct Central Texas origin; these include Ensor, Frio, and San Marcos projectile points. Mallouf (1985) has suggested that their presence is related to moister conditions that characterized the early part of the period; populations moved westward to take advantage of migrating bison that were unexpectedly available in the area.

Some specialization of plant processing is indicated by the identification of distinctive burned rock features – ring middens. Mallouf (1985) associates ring middens with the exploitation and processing of desert succulents. Ring middens in which late Archaic components have been identified have been found in nearly all environmental zones. While there is a clear emphasis on the likely processing of desert succulents, Mallouf (1985) also suggests that incipient agriculture had been practiced in the region starting around A.D. 200 or so.

Late Prehistoric (A.D. 900-1535) and Protohistoric (A.D. 1535-1700) Periods

Throughout most of the eastern Trans-Pecos Region, the introduction of the bow and arrow marks the single technological innovation that was adopted marking the onset of the Late Prehistoric period (Cloud 2004). Agriculture, as a supplement to the predominant diet provided by hunting and gathering, had been practiced during the Late Archaic but the predominantly dry conditions across most of the eastern Trans-Pecos Region played a part in preventing its taking hold to any greater degree.

Table 3.2.
Trans-Pecos Regional Chronology (from Cloud 2004; Miller and Kenmotsu 2004)

Period/Phase	Approximate Date
Paleo-Indian	10,000-6,000 B.C.
Archaic	6000 B.C.- A.D. 900
Early	6000-3000 B.C.
Middle	3000-1000 B.C.
Late	1000 B.C.-A.D. 900
Late Prehistoric	A.D. 900 to 1535
Livermore Phase	A.D. 900-1200
La Junta Phase	A.D. 1200-1400
Late Prehistoric/Protohistoric	A.D. 1400-1700
Concepcion Phase	A.D. 1400-1650
Cielo Complex	A.D. 1300-1700
Historic	A.D. 1700-present

The primary exception to this is the area immediately around Presidio, in a region called 'La Junta de los Rios' (the junction of the rivers), where the Rio Conchos, from the south, empties in the Rio Grande. In the well-watered La Junta district, populations adopted the regular practice of agriculture and ceramic technologies, and lived in settled villages, beginning around A.D. 1200. The following discussion is primarily focused around this area.

There are three phases defined for the Late Prehistoric period in this region (Kelley et al. 1940). The earliest of these, from roughly A.D. 900-1200, is the Livermore phase, which was characterized by a continuation of a hunting and gathering adaptation, followed by the La Junta phase (A.D. 1200-1400), and Concepcion phase (A.D. 1400-1700), which are characterized in the La Junta district by an increased agricultural dependence and a greater degree of sedentism. An explanation of the ending date for the Concepcion phase is required before describing the developments for each. The La Junta district developments, known as the Bravo Valley Aspect, continue into historic times, though the primary period of its occurrence is during the Prehistoric period. For the sake of congruency in discussion of this developmental sequence, the Bravo Valley aspect is included, in its entirety, in a single section in spite of the slightly odd dates for ending of the second phase of its development.

Arrow points associated with the Late Prehistoric period include Clifton, Toyah, Scallorn, Perdiz, Livermore, Harrell, and Fresno types. These are found at both the settled villages and hunter-gatherer sites outside the La Junta area; clearly, then, interactions between the sedentary and mobile populations were occurring, but the nature of these interactions is poorly understood (Cloud 2004).

Site locations are present in all environmental zones, hearths are common site features, and ring middens (circular accumulations of burned rock representing large roasting ovens) become frequent. Stylized rock art, the use of geographic features such as shrines, prepared burials, and ceremonial artifacts such as prayer sticks and elaborate rattles are also found (Mallouf 1985:146).

Livermore Phase

The Livermore phase (A.D. 800-1200) is defined and characterized by the presence of three arrow point types: Livermore Barbed, Toyah Triple Notched, and Fresno Triangular (Kelley et al. 1940; Cloud 2004). Beveled knives are also included in a toolkit adapted to a hunting and gathering lifestyle (Cloud 2004). There is, in all, limited information on this phase; Mallouf (1999) suggests that it is widespread, encompassing the eastern Trans-Pecos region and extending into adjacent parts of southern New Mexico and northern parts of Coahuila and Chihuahua, in Mexico. The limited information has caused speculation on the origin of this phase, from the entrance of a new mobile group to the area from the north, possibly Plains Indians (Kelley 1952a), or an existing indigenous group (Mallouf 1999).

Bravo Valley Aspect

The Bravo Valley Aspect consists of two temporal periods – the La Junta and Concepcion phases. Both include the populations that lived in the La Junta region in at least semi-sedentary villages.

La Junta Phase

The La Junta phase (A.D. 1200-1400) comprises the only part of the Bravo Valley aspect wholly attributable to the prehistoric period. It is during the La Junta phase that we first find evidence of sedentary or semi-sedentary villages (Cloud 2004). Structural types are small pithouses, measuring about 3 by 2 m in diameter (Miller and Kenmotsu 2004). They are built into relatively deep pits, over which jacal walls were built. These small villages are located primarily on the alluvial and Pleistocene terraces of the Rio Grande (Miller and Kenmotsu 2004).

The ceramic assemblage associated with La Junta phase remains, however, forms a reliable basis for temporal assignment. Ceramic types typically include El Paso Polychrome and El Paso brownware (most likely undecorated portions of polychrome vessels) and Chupadero Black-on-white, as well as decorated Chihuahuan wares, such as Playas Red, Playas Red Incised, Villa Ahumada Polychrome, Babicora Polychrome, Madera Black-on-red, Ramos Black, and others not specifically identified (Kelley 1985:156). This time period is coeval with the El Paso phase of the Jornada Mogollon sequence to the west and with Casas Grandes, a large redistribution center in northern Chihuahua to the southwest. Interactions, at some level, are indicated between residents of the La Junta area and these two regions (Cloud 2004).

The origins of these sedentary villages are not presently well understood. Some (Kelley 1952a; Lehmer 1958) suggest that they derive from the Jornada Mogollon to the west; this is supported by substantial architectural similarities between the two regions as well as the presence of El Paso-style pottery at La Junta phase sites (Miller and Kenmotsu 2004). Others (Miller 1994; Sebastian and Larralde 1989) suggest that the villages were founded by seasonally mobile populations who temporarily settled at the La Junta de los Rios to exploit specific resources. It should be noted, however, that the Jornada culture region is not well defined in northern Mexico and that the movement of peoples eastward from northern Chihuahua should be considered when tracing origins of the Bravo Valley aspect.

Concepcion Phase

The Concepcion phase (A.D. 1400-1700) begins before, and continues after European contact, securing a position as straddling the boundary between the Prehistoric and Protohistoric periods. Architectural styles change slightly during this phase, but the documented changes may not constitute reliable indicators of specific temporal affiliation (Kelley 1985:156). Ceramic assemblages do change dramatically during the Concepcion phase, most notably through the absence of El Paso Polychrome (Johnson 1977:19). While the list of ceramics associated with this phase has not been well defined, Chinati Plain and its variants, Chinati Neck-filleted and

Chinati Scored, as well as Capote Red-on-brown and Paloma Red-on-gray are represented. The coccoidal-bottomed Chinati wares have been described as reminiscent of Apachean and Navajo ceramics, which may suggest manufacture by the Jumano (Kelley 1985:158). The Jumano were described by the Spanish as hunter-gatherers who wintered at La Junta alongside the Puebloan agriculturists. The Jumanos are generally considered to represent Plains nomads, persisting in Archaic-style subsistence practices while trading and interacting with groups that were more sedentary. After about A.D. 1700, the use of the term Jumano is discontinued, and the local nomadic peoples are referred to as Apaches (Kelley 1985:159). After initial Spanish contact in 1580, artifacts of European origin, such as glass and metal, began to appear on Concepcion phase sites.

Cielo Complex

Beginning during the Late Prehistoric period and continuing into historic times, a group of hunter-gatherers apparently occupied portions of the La Junta area. Known as the Cielo complex (A.D. 1300-1700), this group seems to have maintained a symbiotic relationship with Pueblo farmers living nearby (Ing and Smith-Savage 1996:27). Cielo complex sites are identified by rock enclosures (typically circular) with associated artifact assemblages lacking ceramics, and tend to be located in elevated locations. Mallouf (1999) suggests that the Cielo Complex may be the archaeological manifestation of Historic-era occupants of the region, known in Spanish documents as the Jumano.

Unfortunately, this complex is poorly represented in published literature for the region and, as a result, is not well understood. The question regarding whether the Cielo complex represents a cultural group distinct from the La Junta agriculturalists or whether the observed difference in material culture is merely a result of variation in subsistence strategies has yet to be resolved (Mallouf 1999).

Historic Period (A.D. 1700-present)

The Historic period in the Trans-Pecos region began with European contact in the sixteenth century. Cabeza de Vaca is credited with being the first Spaniard in the Trans-Pecos, when, after having been shipwrecked on the Gulf of Mexico coast and held captive by native inhabitants, he escaped and wandered through the Trans-Pecos area in 1535 (Hicks 1989:139). Subsequently, the formal expeditions of Rodriguez Chamuscado (1581), Espejo (1582), and Oñate (1598) followed several decades later, with Oñate's founding of Santa Fe marking the inception of colonization. By 1659, the first Trans-Pecos outpost and mission had been established in the El Paso area (Beckett and Corbett 1992:5). Indigenous peoples encountered in the Trans-Pecos area included agriculturists (first designated by the Spanish as the Patarabueyes), as well as nomadic bison hunters, later referred to as the Jumano. Both groups were reported in the area of the Rio Grande/Rio Concho confluence near present-day La Junta or Presidio, Texas.

Although plans for a series of Spanish presidios had first been suggested in 1667, none were established until 1729 when isolated settlements along the Spanish frontier were subjected to continuing raids by Apache and Comanche bands. The first attempted presidio along the Rio Grande, however, soon failed. Following the Pueblo Revolt of 1680, Spanish and sympathetic Pueblo Indians had retreated southward, which eventually led to the establishment of numerous missions in the El Paso area (Beckett and Corbett 1992:9). It was not until 1738 that presidios were successfully established along the Rio Grande south of the El Paso missions, the first being located some 30 mi (48 km) south of present-day Del Rio. In 1759, another presidio was constructed in the present-day La Junta region but reportedly failed to curtail the Apache depredations in the area. Attempts to establish presidios and ongoing campaigns against the Apache continued until 1791, when a peace treaty was signed. Southward pressure by the Comanches shortly thereafter led to encroachment on Apache territories, thus rekindling frictions and forcing the withdrawal of the Spanish from the Big Bend area (Hicks 1989:139). Meanwhile, along the Rio Grande, villages inhabited by the so-called Patarabueyes were being abandoned (Riley 1987:295-297). Undoubtedly, some of these peoples settled within the protective sphere of Spanish presidios (Beckett and Corbett 1992:15). It is not unlikely that others abandoned village life to return to a more nomadic subsistence, removing themselves from the focus of raiding parties.

Uncertainties surrounding these aboriginal groups plague archaeological interpretations. It has been suggested that the Jumano were Apachean, or Athapaskan, speakers (Kelley 1952a:277-278; Riley 1987:297-298). Other researchers have argued that this historic-period group may have been derived from the northern Rio Grande pueblos (Whalen 1977:8) and were part of the Uto-Aztecan linguistic group. Regardless of their cultural affiliation, both agricultural and nonagricultural peoples (other than the Apaches) were present during the Spanish exploration period.

It was not until after 1846 that Euro-Americans substantially settled the Trans-Pecos region. At that time, border and frontier defenses of the newly acquired state of Texas came under the administration of the United States (Bandy 1980:10). Construction of a series of military forts followed, which provided ample protection for the establishment and use of the Chihuahuan trail, a commerce and information artery that linked the Trans-Pecos and western Texas to Chihuahua, Mexico. By the 1880s, the threat of Indian attacks was under control and railroad construction was rapidly paving the way for an influx of settlers and supplies across the Trans-Pecos (Kennard 1973:20-28). Other developments during the nineteenth century that shaped the economic development of the region included the introduction of Hereford cattle breeding and barbed wire, the installation of water wells and irrigation technology, and finally, the development of the mining industry. Today, cattle and sheep ranching constitute one of the major sources of livelihood in the region.

Spanish, Mexican, and Anglo-period historic sites have not been extensively studied in the general Presidio project area. Excavations were conducted at Fort Leaton (41PS18), a Texas State Historic Site, in 1971 and 1973 (Ing and Kegley 1971; Ing and Robertson 1974).

LOWER RIO GRANDE FLOOD CONTROL PROJECT AREA: SOUTH TEXAS PLAINS

The South Texas Plains culture region encompasses the region in which the Lower Rio Grande Flood Control Project Area lies. Many researchers (Black 1989; Cooper et al. 2003; Hester 2004; Ricklis 2004) have summarized the prehistoric sequence in this region; the following discussion has been distilled from those publications. A primary difficulty with the South Texas Plains data – with regards specifically to chronology and interpretation – is a general lack of preserved and intact archaeological remains. The evidence for extensive use of the region throughout prehistory is there; but open campsites dominate the site types, and these have generally been heavily eroded (Hester 2004).

The prehistoric cultural sequence for South Texas is separated into three sequential temporal and cultural periods: Paleo-Indian, Archaic, and Late Prehistoric (Table 3.3). The dates for this chronology are based on a comprehensive study of the region conducted by Black (1989).

Table 3.3.
Regional Chronology of South Texas (from Black 1989)

Period	Date
Paleo-Indian	9500 – 6000 B.C.
Archaic	6000 B.C. – A.D. 800
Early Archaic	6000 – 2500 B.C.
Middle Archaic	2500 – 400 B.C.
Late Archaic	400 B.C. – A.D. 800
Late Prehistoric	A.D. 800 – 1519
Historic Aboriginal	A.D. 1519 – 1746
Historic	A.D. 1746 – present

Paleo-Indian Period

Based on limited paleoenvironmental data and lithic assemblages, the Paleo-Indian period (ca. 9500-6000 B.C.) in the Lower Rio Grande Flood Control project area in South Texas is typically characterized as the period when small nomadic groups hunted Late Pleistocene megafauna. It is presently assumed that the Rio Grande, a large regional drainage, was an important resource in the Paleo-Indian period as it is in later periods, though data supporting this presumption are slim. In addition, estuarine and coastal resources available near the mouth of the Rio Grande would also likely have been important resources to Paleo-Indian populations in the Lower Rio Grande Valley.

Paleoenvironmental data for neighboring regions, like south-central Texas, have indicated that temperatures during this time period were generally cooler and the climate more humid (Bousman et al. 1990). Paleo-Indian populations likely hunted extinct species including mastodon, mammoth, large tortoise, and long nosed peccary. Other species, such as bison, that no longer inhabit the area, were probably also used by these populations (Black 1989; Bousman et al. 1990). Though few regional data exist relevant to this period – and thus extrapolated from adjacent areas – Paleo-Indian lifeways probably included a much greater use of both plants and animals than the current understanding and artifact assemblages indicate.

No Paleo-Indian period sites, nor confirmed isolated finds dating to this period, have been recorded or reported from within the USIBWC project area. A few sites and isolated finds, however, have been reported from nearby areas and they give an idea of what could be present. Some, such as the Perdida Site (Weir 1956), located in Starr County but north of the USIBWC project area, are lithic scatters with thousands of years' worth of diagnostic projectile points all found on the exposed modern ground surface. The site's surface assemblage contained several projectile point types, including Plainview, Meserve, Angostura, Scottsbluff, and Clovis. Hundreds of projectile points however, dating to several different temporal periods, were documented from the surface of the site and subsurface investigations were not conducted; subsurface deposits may be present but are unlikely. Sites in Willacy County, well to the north of the project area, produced extinct tortoise shell fragments that were dated to 9,360±415 Before Present (B.P.) from an undisturbed context 70-80 cm below the surface (Bousman et al. 1990), thus indicating the possibility of buried deposits dating to this era in the region. Rare isolated Paleo-Indian artifact discoveries include a Folsom projectile point base found near Laguna Atascosa (Anderson field notes, TARL files), and a Lerma-type projectile point found within the dune fields of Willacy County (Mallouf et al. 1977:167-168), both well to the north of the USIBWC project area. While isolated finds, such as these, could indicate use of the area by

Paleo-Indian populations, they might also have been curated items picked up by later prehistoric populations and dropped – by accident or intention – where they were later found.

Archaic Period

The Paleo-Indian to Archaic period transition in the South Texas Plains is marked by a shift from an emphasis on a big-game hunting subsistence strategy to one with a more generalized broad-spectrum hunting and gathering strategy (Black 1989). This subsistence modification was accompanied by gradual changes in technology, settlement, and population as well.

Early Archaic Period

The Early Archaic period (6000 B.C.-2500 B.C.) has been suggested as being a shift from a highly nomadic hunting and gathering lifestyle to a slightly less mobile, broader-spectrum subsistence strategy. A reduction in large game species caused by depredation and/or environmental factors may have promoted usage of a greater diversity of plant and animal resources. Subsistence data that do exist for areas adjacent to the South Texas Plains indicate use of fresh-water mussels, land snails, turtle, and fresh-water drum (Scott and Fox 1982).

The reasons for the transition from Paleo-Indian lanceolate points to the Early Archaic stemmed dart point is not yet understood, but this technological change appears to mark the end of the Paleo-Indian period. Early Archaic projectile point styles within the Coastal Bend of South Texas, as described by Black (1989), include Andice, Bell, Early Triangular, and early expanding stem forms such as Bandy, Martindale, Uvalde, and other similar dart points. Also included in these assemblages are "large thin triangular bifaces with concave bases and Guadalupe and unifacial Clear Fork distally beveled tools" (Black 1989:49).

As with the Paleo-Indian period, few Early Archaic data exist for the lower Rio Grande valley. In fact, no Early Archaic period sites have been recorded from within the USIBWC project area. Extrapolations from inland and coastal areas to the north and northeast indicate that groups during this time remained small in size and were highly mobile within relatively large territories (Black 1989; McKinney 1981). Most sites are located on high terraces, or upland locations, though a few Early Archaic period components have been found deeply buried in alluvial deposits well to the north of the project area (Scott and Fox 1982).

Middle Archaic Period

Little evidence of Middle Archaic (2500-400 B.C.) assemblages exists within the lower Rio Grande valley. No specifically identified Middle Archaic period sites are known to lie within the bounds of the USIBWC project area; again, the data presented below are extrapolated from adjacent areas in order to form a broad picture of cultural adaptations during this time period.

As presently known for South Texas, the Middle Archaic period continues the shift to a greater reliance on plant resources, based on the presence of dated burned rock middens that might be related to those found in central Texas (Hall et al. 1986). Open campsites may be found on floodplains, terraces, and natural levees along present and former stream channels. Hearths, earth ovens, and burned rock accumulations are also found (Black 1989; Hester 2004). Late in the Middle Archaic period, and continuing somewhat into the Late Archaic, cemeteries are found in parts of South Texas (Hester 2004), though, again, none have been recorded in the project area. These are found to both the north and upriver, possibly including the Falcon Reservoir area.

Middle Archaic period lithic technologies are identified relatively easily in the archaeological record; triangular dart points, particularly Tortugas and Abasolo, dominate within the lithic assemblages (Hester 2004:138). Other projectile point types and lithic tools that occur in the Middle Archaic include Matamoros, Palmillas, Morhiss, and Bulverde dart points, and unifacial and bifacial distally beveled tools that have been heavily reworked and resharpened. Other artifacts appearing in the archaeological record from this period include incised bone, tubular stone pipes, conch columella gouges, and conch adzes (Black 1989).

Late Archaic Period

Late Archaic period sites (400 B.C.-A.D. 700) are more common within the lower Rio Grande valley and are often observed in association with Late Prehistoric period assemblages. This association may reflect a long projectile point tradition being carried into the ceramic period or a reuse of site locations. Sites are characterized by dense accumulations of burned rock, hearths, and earth ovens. They are located adjacent to present stream channels. Lithic procurement sites used during this time period are found in areas where Rio Grande gravels are exposed; these are expansive sites common to high terraces (Hester 2004). While cemetery sites may have continued throughout the southern and central coastal region of Texas (Hall 1981; Lukowski 1987), isolated burials may also be found throughout the region (Hester 2004).

Corner-notched or side-notched projectile points, as well as smaller triangular styles, typify those found in Late Archaic assemblages and include Ensor, Frio, Marcos, Fairland, Catan, Matamoros, and Ellis dart points. Beveled tools are common, and corner-tanged bifaces, while found, are more rare (Black 1989). Ground stone artifacts are also frequently identified at these sites.

Subsistence data indicate use of a wide variety of fish, shellfish, and small mammals, suggesting a greater emphasis on collection rather than hunting and gathering. Farther inland, a variety of plant species was utilized, in addition to small mammals (rabbits, rodents, etc.). Population densities were higher during this period than before and may have been a continuation of population growth during the Middle Archaic (Black 1989). Trading of items between inland and coastal groups is suggested by the presence of shell pendants some distance inland (Hall 1981).

Late Prehistoric Period

The Late Prehistoric period (A.D. 800-1600) is probably the best understood of the prehistoric sequence because the remains are more numerous and better preserved than those of previous periods. Radiocarbon dates from this period are relatively more common, allowing for more precise temporal control. In addition, the few ceramics that exist have aided in understanding the Late Prehistoric period in South Texas.

Near the mouth of the Rio Grande, on the deltaic plain, a distinctive Late Prehistoric period complex has been defined that began around A.D. 1000. The Brownsville Complex, first postulated by Sayles (1935), is relatively well confined to the Rio Grande Delta. Characterized particularly by the manufacture of shell ornaments, the presence of ‘exotic’ lithic materials such as obsidian, jadeite, and serpentine, and ceramics, this complex likely has an origin in the Huastecan region of Mexico (Ekholm 1944; MacNeish 1947; see discussion in Ricklis 2004).

Several Late Prehistoric period cemetery sites have been documented in the lower Rio Grande valley area, though not within the present project area. Two of the larger, better-studied sites are the Floyd Morris site (41CF2; Collins et al. 1969) and the Ayala site (41HG1; Campbell and Frizzell 1949; Hester and Rodgers 1971; Hester and Ruecking 1969). These sites are discrete cemeteries and appear not to be associated with habitation areas. Many of the graves contain quantities of funerary items, and the human remains are usually discovered in bundled or flexed positions. Cremated remains and skeletons covered in red ochre have also been located (Campbell and Frizzell 1949; Hester 1969). The formal cemetery sites, the shell industry, and the Huastecan-like ceramics may strongly indicate semi-sedentary settlement and subsistence strategies during the Late Prehistoric period in this region.

Subsistence data – from limited numbers of excavations as well as extrapolated information from ethnohistorical documents – suggest that the river and the coast both played strong roles during the Late Prehistoric period. Hunting, gathering of plant resources, and fishing are all represented (Ricklis 2004). These populations were likely semi-sedentary, establishing seasonal or temporary camps in places where specific resources might be available.

Historic Aboriginal Period

With the European discovery of the area in 1519 and the subsequent exploration, traded and discarded European goods became available to aboriginal groups. Later, Spanish settlements traded with aboriginal groups and educated them in such skills as wheel-turned pottery making. Consequently, these sites contain artifacts that include glass or metal projectile points, trade beads, and wheel-made ceramics, augmenting previous technologies with new materials. Four historic aboriginal sites have been located within the lower Rio Grande valley, including 41CF8 and three others discovered by A. E. Anderson (Kibler 1994).

Historic Period

The lower Rio Grande valley has long been settled and is rich in history. The following discussion on the history of the Lower Rio Grande region is taken from Cooper et al. (2003). The history of the U.S. portion of the lower Rio Grande is also intermeshed with the history of Mexico. For additional information, the reader is directed to the many fine volumes that have been written on this topic (Alonzo 1998; Fontana 1994; Graham 1994; P. Kelley 1986; Perttula et al. 1997; Sánchez 1994; Tijerina 1998).

Early Exploration

The first European to visit the lower Rio Grande valley was probably Alonso Alvarez de Piñeda. Piñeda was commissioned in 1519 by Francisco Garay, then-governor of Jamaica, to explore and map the coast of Florida in hopes of finding the Southwest Passage (Sánchez 1994:21). The Southwest Passage was thought to be an all-water route to the Orient. With four ships and 270 men, Piñeda mapped the Gulf of Mexico coast from present-day Florida to Veracruz, Mexico. It is not known whether he landed on or explored any of these coastal regions (Fontana 1994:17-18).

Upon its arrival in Veracruz, the Piñeda expedition met the conquistador Hernando Cortéz, who was planning an assault on the Aztec. Piñeda turned northward again, at the mouth of what he called the Rio de las Palmas, went ashore, and claimed the land for Spain, which would rule the region for the next three centuries. Rio de las Palmas is generally considered to have been about 120 miles south of the mouth of the Rio Grande (Sánchez 1994:21).

In 1520, Francisco Garay sent forth another expedition, this time led by Diego de Camargo. Camargo had with him "three ships, 150 infantrymen, seven cavalrymen, brass cannon, building materials and several masons" (Sánchez 1994:21). Camargo, charged with establishing a fort at the mouth of the Rio de las Palmas, however, mistook the Rio Grande for the Rio de las Palmas. He sailed upriver for about 20 miles and found most of the native inhabitants hospitable and friendly, with the exception of the Coahuiltecans. When a show of force intended to impress the Coahuiltecans backfired, open warfare developed. During the following battle, 18 of Camargo's men were killed, and the entire group was forced to flee back to the Gulf (Sánchez 1994:22). The party eventually returned to Veracruz after losing two of the ships. While in port, the third ship sank, and shortly thereafter Camargo died from exposure and the lingering effects of his failed expedition. The men remaining in his command joined forces with Cortéz.

In 1523, Francisco Garay himself led an expedition to the mouth of the Rio Grande. He came with an impressive force of 16 ships and 750 men. Not knowing that the Camargo expedition had failed, he had come with the expectation of expanding the nonexistent fort. After learning of the fate of the Camargo party and receiving the negative report on the suitability of the Rio Grande area for settlement given him by his exploratory group, he too turned southward toward Veracruz.

Spanish interest in settling the lower Rio Grande valley region was not renewed until 1686 when rumors began to trickle in about the establishment of a settlement somewhere on the Gulf Coast of Texas by the Frenchman René Robert Cavalier, Sieur de La Salle. Spain's interest in the area was clear and Alonso de León was soon sent to investigate the rumors. La Salle's settlement was at one time thought to be at the mouth of the Rio Grande, and in 1686, de León investigated this region but failed to find any evidence of the French. He was however, informed by three captured Indians that they had seen "white men" somewhere to the north. Alonso de León set out again in 1687; intent on finding the French but was once more disappointed. He was ultimately rewarded in 1689, however, when he found the remains of the decaying French Fort St. Louis farther to the north along Garcitas Creek. De León, accompanied by Father Damien Massanet, returned a final time in 1690 to bury the remaining munitions and to burn what was left of the fort. Soon after, de León and Father Massanet established Mission San Francisco de los Tejas close to the Neches River in southeast Texas in present-day Houston County.

In 1700, near the present-day village of Guerrero, Coahuila (30 miles downriver from Eagle Pass), three missions and the presidio of San Juan Bautista were established. The presidio of San Juan Bautista was under the command of Capt. Diego Ramón and was manned by his company of 30 mounted cavalrymen (Sánchez 1994:24). These developments, along with the establishment of San Francisco de los Tejas, opened the southern Texas area to more regular traffic, and serious consideration was given by Spanish colonial administrators to starting permanent establishments in the lower Rio Grande valley.

Colonial Settlement

The Spanish colonial administrators in New Spain originally intended for settlements in Texas and Nuevo Santander to be established as a line of northern defense. They called this protective line of defense the "frontera", and their strategy was to settle the frontera with a hearty stock of people who would serve as a buffer colony protecting Monterrey and Saltillo from the hostile American Indians of Texas" (Tijerina 1998:xx). In 1746, Juan de Escandón was chosen to lead the endeavor to establish a protective *frontera* in Nuevo Santander and Texas (Sánchez 1994:25).

Numerous journals and diaries were kept describing the terrain. From these records, it appears that the Escandón party was able to ascertain that three separate rivers ran into the Rio Grande from the south: the Salado, the San Juan, and the Alamo. Escandón hoped to establish settlements near these three rivers since the surrounding areas could be easily irrigated (Alonzo 1998:29).

Traditionally, when Spain entered a new territory, a well-established system of setting up colonies was used. This system, overseen by a colonial governor, consisted of establishing a presidio—under the command of a military commander—and one or more missions in areas that could be protected by the garrisons that were housed at the presidio. Ranchos (ranches) were set up, usually at some distance away, that supplied meat and produce to the presidio and missions. While civilians would often accompany the soldiers, these settlements were essentially set up for the good of the Crown of Spain.

Over a span of four years, primary settlements were founded along the south bank of the Rio Grande: La Villa de Santa Ana de Camargo (Camargo), established 1749; Nuestra Señora de Guadalupe de Reynosa (Reynosa), established 1749; Villa de San Ignacio de Revilla (Revilla), later known as Guerrero, established 1750; and Lugar de Mier (Mier), established 1752 (Sánchez 1994:27-28).

Settlement efforts to the north of the Rio Grande were not undertaken as quickly as those to the south. In general, the land was not considered as favorable because of limited amounts of water and a much greater chance of Indian hostilities. However, in 1750, José Vasquez Borrego became the first Spaniard to establish a settlement north of the river. This settlement, known as Nuestra Señora de los Dolores, was located upriver from the project area. It began as a rancho and then continued as a small community until 1815, when continuous attacks by Indians, especially the Comanche, forced abandonment of the settlement.

European settlement eventually took hold north of the Rio Grande. Don Tomás Sánchez de la Barrera y Garza, like other settlers south of the Rio Grande, began to look with interest at the land north of the river for a variety of reasons. Chief among these was the possibility of enlarging his grazing lands. Around 1755, Don Tomás established Laredo, the first major settlement north of the Rio Grande.

Having made the promise of free land to settlers, the Spanish government began to consider a method for making property concessions. In 1767, the Spanish authorities appointed the Royal Commission under the leadership of Juan Fernando de Palacios. It has been rightly observed that the visit of this commission north of the Rio Grande was a momentous event in the history of the lower Rio Grande valley. While people were already living in communities throughout Nuevo Santander, the commission formalized these settlements and provided official grants for lands.

Most of the original land grants—in the form of either *porciónes* or ranchos—in the project area were established from the apportionments initially set up by Escandón (Alonzo 1998:36-39). The *porciónes* were long and thin, running perpendicular to the river, to allow equitable access to water. Beyond the riverfront *porciónes*, Escandón had established a wider band of very large cattle-grazing ranchos. These ranchos on the Rio Grande, along with those around San Antonio, were the beginnings of the American cattle industry. The commission made every effort to grant the same lands to those persons who were already settled on particular pieces of property. When this was not possible, monetary compensations were made for such improvements as houses, corrals, etc., that had already been built.

Because these ranchos were essentially family enterprises—in addition to existing for the good of the Spanish Crown (Tijerina 1998:xxi)—a number of these eighteenth-century ranchos and *porciónes* remained in operation long after Texas was annexed, and many modern families can proudly trace their ancestry back to the original land grant owners. A commission created after Texas became a state confirmed the ownership of most of these land holdings. Although for most of these ranchos the exact locations of structures are not known, some of them have the possibility of retaining intact archaeological remnants.

There is currently a paucity of information on Spanish colonial archaeology from the Lower Rio Grande valley, despite the well-documented historical record. For an elucidation of these deficiencies, see Fox (1989:91) and Chapter 5 of this report.

Tides of Change

These large-scale ranching operations continued to provide the primary occupation in this portion of the project area for many years. However, significant political changes occurred that affected the area from ca. 1800 to 1920 because the lower Rio Grande valley was often disputed territory. These impacts were reflected directly throughout the project area in the form of troop movements and numerous battles. Beginning in 1821 with Mexican Independence from Spain, the area was in political upheaval until Texas achieved statehood in 1846. Both the Republic of Texas and Mexico laid claim to the region, just as the United States and Mexico would do later. Even after statehood, the area was the setting for various conflicts involving the Mexican-American War (1846-1848), the escapades of Juan Nepomuceno Cortina (1859-1860), the Civil War (1861-1865), and Mexican political upheavals and revolution (1865-1918).

One early conflict that impacted the region resulted in the short-lived Republic of the Rio Grande. At the time of Texas independence in 1836, Mexico refused to relinquish its claim on lands in the Rio Grande valley and continued to garrison the small villages along the river. Soon unhappy Mexican citizens who wanted more self-determination than they had under Mexico's centralist government began to protest. Conflicts between Mexican troops and Mexican citizens began to erupt. Because many Mexicans owned property on both sides of the river these engagements took place on both sides as well. Much of this conflict took place in the lower reaches of the Rio Grande, where men such as Antonio Canales and Antonio Zapata (after whom Zapata County is named) led the revolt. In 1840, Canales called for a convention to meet and form the Republic of the Rio Grande. Laredo was to serve as the capital (Sánchez 1994:35). However, forces from the Mexican central government soon entered Laredo and the revolution was put down.

Shortly after Texas won its independence from Mexico, the Mexican government attempted to regain Texas. Between 1842 and 1844, a second Texas-Mexican war took place upriver from the project area. Santa Anna refused to recognize the Republic of Texas and went so far as to order Mexican soldiers across the Rio Grande. This intrusion, of course, led to hostilities between Mexico and Texas. Skirmishes continued until Mexican forces at the Battle of Mier soundly defeated a rag-tag company of Texas soldiers. Eventually though, in 1844, a peace treaty was signed between Santa Anna and the Republic of Texas.

Relative peace was short-lived, however. In 1845, anticipating formal annexation to the United States, General Zachary Taylor set up camp with his "Army of Observation" in Corpus Christi and was in position to deal with conflicts and uprisings. The Rio Grande region was, as always, a point of contention between the United States and Mexico. After annexation was complete in March 1846, Taylor moved his army from Corpus Christi to the Rio Grande. At that time, there was not a single village between the Nueces River and the Rio Grande, possibly because of a scarcity of water. Taylor and his army set up camp across the river from Matamoros and construction began on earthen fortifications. Initially, these fortifications consisted of a six-sided bastion 8 to 9 feet in height (Carlson et al. 1990:8), christened Fort Texas.

Prior to completion of the fortifications at Fort Texas, Taylor learned that the Mexican forces had moved downstream from his position across from Matamoros. Taylor left a contingent of soldiers at Fort Texas and took his main force downriver to meet the Mexican intruders. After engagements at Fort Texas, Palo Alto, and Resaca de la Palma, the Mexican forces were driven back into Mexico, and hostilities formally ceased with the signing of the Treaty of Guadalupe Hidalgo in February 1848. Fort Texas was renamed Fort Brown in honor of Major Jacob Brown. Brown, who had been left in charge of the troops at Fort Texas when Taylor left to engage the Mexican troops elsewhere, had sustained fatal wounds during the engagements with Mexican forces.

The Treaty of Guadalupe Hidalgo contained language that had a direct bearing on the project area. The first provision made the United States responsible for containing marauding Indians, and the second provision made the Rio Grande an "International Waterway," recognizing Mexico's right to use the river for transportation (Carlson et al. 1990:8). The first provision had the immediate result of upgrading Fort Brown. A new fort was laid out about one-half mile upriver from the original fortifications; and, although crude by some standards, this new fort was built of wood and contained many structures. Fort Brown, in various configurations, continued to be maintained until it was deactivated in the mid-twentieth century. In 1948, the former military facility became part of the campus of Texas Southmost College.

Fort Brown is located within the boundaries of the current study (i.e., within one-half mile of the Rio Grande) and the entire site area is listed on the National Register of Historic Places (designated as site 41CF96). Previous archaeological and historical research at Fort Brown is summarized in Carlson et al. (1990), Marcum (1964), Moir et al. (1993), Perttula et al. (1997), Sides (1942), and Hartman et al. (1999). This work suggests that much of the archaeological deposit at Fort Brown may still be intact, and deeply buried historic artifacts have been identified in the Old Resaca portion of the Fort (Kuehn and Dering 1999). In addition, Perttula et al. (1997:25-25) indicate that Mexican fortifications from the 1840s may now lie in the United States due to the shifting course of the river.

Both the Palo Alto and the Resaca de la Palma battlefields are located just outside the current project area boundaries. Both sites, however, are important National Register of Historic Places properties and both have the focus of significant historical archaeological research (Bond 1979; Haeker and Mauck 1997; Collins et al. n.d., Hester 1978).

From the time the Rio Grande was first encountered by explorers and settlers, an interest was generated in using its waters for transport and trade. The first attempt to travel upriver by steamship was made around 1828 (P. Kelley 1986:18-19); its main purpose was not trade but exploration. How far upriver the navigators reached is not recorded. Shortly thereafter, an enterprising native of Maine named Alpheus Rackliffe began a flatboat business in 1829 that ran a regular route as far upriver as Presidio Del Rio Grande, situated on the south side of the river and across from present-day Eagle Pass.

Finally, after the annexation of Texas to the United States in 1846, regular river traffic developed. This was facilitated by the construction of a shipyard located near the mouth of the river that could both build and repair ships. The shipyard had been built at the behest of General Zachary Taylor, who felt that steam power was the most logical way for him to transport men and supplies during the Mexican-American War (P. Kelley 1986:31). During this period (1846-1848), the *Major Brown*, under the command of Captain Mark Sterling, made a thorough examination of the Rio Grande and traveled upriver as far as Laredo.

The Mexican-American War brought other men to the river that would have a dramatic impact on the region; they were Mifflin Kenedy, Richard King, and W. W. Chapman. These men, along with Charles Stillman of Brownsville, would come to dominate river trade. Much of the early success of steamboat traffic on the Rio Grande was due to the constant demands of supplies for the large military presence along the river because of the Mexican-American War. When regular steam traffic was initiated, the town of Roma became the head of navigation on the Rio Grande. Steamboats continued to be a profitable pursuit until the coming of the railroad in the 1880s. There is one known steamboat wreck (41CF177) within the project area close to Brownsville and numerous reports of boats lost in or near the Rio Grande that represent potential shipwreck remains. Reliable historical accounts identify several more potential shipwrecks that have not been located.

Secession and Civil War

The Texas Secession Convention met in Austin in 1861 and voted overwhelmingly to secede from the United States. The citizens of the lower Rio Grande valley agreed with the vote. The issue of slavery was not considered important since “in the border counties from Laredo to the gulf, only fourteen slaves were listed in the 1860 census” (Sánchez 1994:55). Pro-secession sentiment in the valley was more a matter of the strong ties many prominent families in the region had to Austin, whose citizens were very pro-secession.

Many encounters between the Confederate and Union forces during the Civil War occurred in the lower Rio Grande valley. Several of these encounters took place in and around Brownsville. As Confederate forces pulled back from the city in 1863, they started a fire in an attempt to destroy their munitions. The fire ultimately destroyed Fort Brown, which was later rebuilt, and spread into Brownsville. Union forces took control of the city on November 6, 1863, and remained in command for over a year. Union forces pulled back in June 1864, and Confederate forces retook the city, which they controlled until the war ended. Fighting was still taking place in and around the valley a month after Gen. Robert E. Lee surrendered to Gen. Ulysses S. Grant. Indeed, the last land battle of the Civil War was fought in the lower valley at Palmito Hill. The Palmito Ranch National Register District is located within the ½ mile wide corridor of the current project.

Turbulence in the Later Nineteenth and Early Twentieth Centuries

Although there were sporadic conflicts, things appear to have calmed somewhat along the border during the period from the 1880s to 1911 under the Mexican leader Porfirio Diaz. After his resignation, a period of revolt started in Mexico and on numerous occasions spilled onto or at least impacted U.S. soils. It is estimated that more than 20 men and women were killed on the U.S. side of the border during the conflicts from 1911-1915. After Francisco Villa’s declared revolt in late 1914, more U.S. citizens were killed. Late in 1915, 17 Americans were taken from a train and killed in Chihuahua. In early 1916, Villistas killed eight soldiers and 10 citizens in the town of Columbus, New Mexico (Pierce 1917:85-86). In the lower Rio Grande valley, numerous small skirmishes and conflicts were reported from 1915-1916.

Irrigation on the Rio Grande

In the early twentieth century, as the potential for agriculture in the lower Rio Grande valley became apparent, several irrigation districts were developed. The San Benito Land and Water Company as well as the American Rio Grande Land and Irrigation Company are only two of these. The latter district was more prominent in the project area. Lands were purchased from the heirs of the original grantees of the Llano Grande and La Feria grants. The first office of the new company was a boxcar on a railroad siding; the second was a two-story building in Mercedes. A settling basin, a pumping plant on the river, a canal, and an electrical plant were built in Mercedes in 1906 and 1907. By 1908, the canals and river pump station had begun operation. In 1920, the system consisted of three large canals, five pumping plants, reservoirs, settling basins, and extensive drainage networks. The Water and Control District No. 9 in Hidalgo and Cameron counties was formed in 1927 by the farmers who owned land in the district, and in 1929, they purchased the irrigation portion of the company. This company is still in existence today.

Levee Building on the Rio Grande

Flood control on the Rio Grande was initiated by a series of treaties and agreements between the United States and Mexico. The treaty of 1906 provided for the construction of Elephant Butte Dam and Reservoir in New Mexico, which gave some protection downriver from flooding. The Rio Grande Rectification Project of 1933 helped relieve flood dangers to the El Paso-Juarez valley. An act of Congress on June 4, 1936, authorized a canalization project between El Paso and Caballo Dam and Reservoir, the Rio Grande Canalization Project, features of which were completed by 1947 (Timm 1999).

Along the lower Rio Grande valley, considerable damage has occurred from periodic heavy floods. Bond issues in 1924 and 1925 resulted in levee building from Donna to Brownsville. A devastating flood in 1932 demonstrated that levees built only on the American side of the river could not provide adequate protection (Timm 1999). On September 3, 1932, the International Boundary Commission (renamed the United States International Boundary and Water Commission [USIBWC] in 1944) recommended the construction of floodways on both sides of the river. An exchange of notes in 1932 between the Mexican and American governments provided for a coordinated plan for flood protection and for each country to perform the work within its own borders, at its own expense. Construction of the features in the United States was initiated with funds made available by the Public Works Administration under provisions of Title II of the National Industrial Recovery Act of June 13, 1933. The Lower Rio Grande Flood Control Project (LRGFCP) was authorized by the act of August 19, 1935 (49 Stat. 660) and subsequent appropriations for construction and maintenance by the Secretary of State acting through the United States Commissioner for USIBWC.

The LRGFCP was constructed in the 1930s without the present Rio Grande diversion dams. The counties turned over to the United States government titles or interests to the levee system and to the lands subject to inundation between levees in the off-river floodway system. The United States government received titles or interests to the river floodway levees but did not obtain title or interest to the lands subject to inundation between the river levee system and the Rio Grande. The LRGFCP was improved after major Rio Grande flooding resulted from heavy localized rains in 1958 and Hurricane Beulah in 1967. The improvements, which included construction of diversion dams and vegetation-clearing programs, were based on United States and Mexico revisions of the 1932 original coordinated flood control plan.

The United States and Mexico, in the water treaty of 1944, agreed to the distribution of the waters of the Rio Grande from Fort Quitman to the Gulf of Mexico. That treaty provided for the international development of major, multiple-purpose reservoirs on the Rio Grande, importantly including flood control as one of these purposes. The construction of Falcon Dam in Zapata and Starr counties was part of this work. Amistad Dam and Reservoir, located just north of Del Rio at the confluence of the Rio Grande and the Devil's River, was begun in August 1963 and was completed in 1968 (Timm 1999). Amistad, in combination with Falcon Dam, provides excellent protection from Rio Grande floods originating above Falcon Dam.

INTERNATIONAL TIJUANA RIVER FLOOD CONTROL PROJECT AREA: TIJUANA RIVER REGION

The following text is summarized from Buysse et al. (1999). Several summaries discuss the prehistory of San Diego County and provide a background for understanding the archaeology of the general area surrounding the project. Moratto's (1984) review of the archaeology of California contains important discussions of Southern California, including the San Diego area. Papers by Bull (1983, 1987), Carrico (1987a, 1987b), Gallegos (1987), and Warren (1985, 1987) as well as reports on projects in the region by Alter et al. (1992), Gallegos and Kyle (1992), Gross et al. 1996, Higgins et al. (1994a, 1994b), Kyle et al. (1996), Robbins-Wade and Schultz (1996), and Smith (1996) provide summaries of recent work and interpretations. The following is a brief discussion of the culture history of the San Diego County region.

Table 3.4.
Regional Chronology of San Diego County

Period	Date
San Dieguito Complex	ca. 8000-6000 B.C.
La Jolla Complex	6000 B.C.-500 / 800 A.D.
Late Prehistoric	A.D. 500 / 800 – 1539
Historic	A.D. 1539-present
Exploration Period	A.D. 1539-1769
Hispanic Period	A.D. 1769-1822
Mexican Period	A.D. 1822-1846
Anglo-American Period	A.D. 1846-present

San Dieguito Complex

The earliest accepted archaeological manifestation of Native Americans in the San Diego area is the San Dieguito complex, dating to between 10,000 and 8,000 years ago (Moratto 1984; Warren 1967). The San Dieguito complex is chronologically equivalent to other Paleo-Indian complexes across North America, and sites attributed to this complex are sometimes called "Paleo-Indian" rather than "San Dieguito." The San Dieguito complex was originally defined by Rogers (1939), and Warren published a clear synthesis of the complex in 1967. Because few San Dieguito sites contain stratified deposits, this period is the least understood of the cultural periods in the San Diego region.

The subsistence pattern of the San Dieguito was originally thought to be primarily based on hunting but is now believed to have included both hunting and gathering, including marine or riverine shellfish (Higgins et al. 1994a). The material culture of the San Dieguito complex consists primarily of scrapers, scraper planes, choppers, large blades, and large projectile points. Rogers (1939) considered crescentic stones to be characteristic of the San Dieguito complex as well. Tools and debitage made of fine-grained green metavolcanic material, locally known as felsite, were found at many sites that Rogers identified as San Dieguito. Often these artifacts were heavily patinated. Felsite tools, especially patinated felsite, came to be seen as an indicator of the San Dieguito complex. Sleeping circles, trail shrines, and rock alignments have also been associated with early San Dieguito sites. Until relatively recently, many archaeologists felt that the San Dieguito culture lacked milling technology and viewed this as an important difference between the San Dieguito and the subsequent La Jolla complexes.

Many sites on Otay Mesa have previously been attributed to the San Dieguito complex based on the high frequency of fine-grained metavolcanics in the region and the predominance of domed scrapers (Alter et al. 1992). However, the presence of fine-grained metavolcanics and domed scrapers, as well as points and knives which are typically attributed to the San Dieguito, have been found on La Jolla sites on Otay Mesa, suggesting these criteria in and of themselves may not be reliable cultural indicators. San Dieguito material underlies La Jolla complex strata at the C. W. Harris site in San Dieguito valley (Warren 1966).

La Jolla Complex

The traditional view of San Diego County prehistory has the La Jolla complex following the San Dieguito complex and dating to at least 7,000 years ago, possibly as long as 9,000 years ago, extending to the Late Prehistoric period (Rogers 1966). The shoreline at the end of the last Ice Age was located farther west due to the lower sea level. The La Jolla complex is part of the Encinitas tradition and equates with Wallace's (1955) Millingstone horizon. The Encinitas tradition, primarily a coastal manifestation, is generally "recognized by Millingstone assemblages in shell middens, often near sloughs and lagoons" (Moratto 1984:147). The La Jolla complex, particularly sites in proximity to the coast, is typified by its pattern of shell middens, grinding tools closely associated with marine resources, and utilized flakes that appear to have been used to pry open shellfish (Smith 1996). Two important coastal sites of the La Jolla complex are SDI-222 and SDI-4281 in Border Field State Park.

The La Jolla complex also exhibits an inland manifestation consisting of a more generalized hunting and gathering pattern with increased quantities of ground stone often seen as reflective of oak or small animal exploitation (Higgins et al. 1994a). "Crude" cobble tools, especially choppers and scrapers, characterize the La Jolla complex (Moriarty 1966). Basin metates, manos, discoidals, a small number of Pinto series and Elko series points, and flexed burials are also characteristic of this complex.

Warren et al. (1961) proposed that the La Jolla complex developed with the arrival of a desert people on the coast who quickly adapted to their new environment. Moriarty (1966) and Kaldenberg (1976) have suggested an in situ development of the La Jolla people from the San Dieguito. Moriarty later proposed a Pleistocene migration of an ancestral stage of the La Jolla people to the San Diego coast. He suggested this pre-La Jolla complex is represented at Texas Street, Buchanan Canyon, and the Brown site (Moriarty 1987).

In recent years, archaeologists in the region have begun to question the traditional definition of San Dieguito people simply as makers of finely crafted felsite projectile points, domed scrapers, and discoidal cores, who lacked milling technology. The traditional defining criteria for La Jolla sites (manos, metates, "crude" cobble tools, and reliance on lagoonal resources) have also been questioned (Bull 1987; Cardenas and Robbins-Wade 1985; Robbins-Wade 1986). There is speculation that differences between artifact assemblages of "San Dieguito" and "La Jolla" sites reflect functional differences rather than temporal or cultural variability (Bull 1987; Gallegos 1987; Wade 1986). Gallegos (1987) has proposed that the San Dieguito, La Jolla, and Pauma complexes are manifestations of the same culture, with differing site types "explained by site location, resources exploited, influence, innovation and adaptation to a rich coastal region over a long period of time" (Gallegos 1987:30). The classic "La Jolla" assemblage is one adapted to life on the coast and appears to continue through time (Robbins-Wade 1986; Winterrowd and Cardenas 1987). Inland sites adapted to hunting contain a different tool kit, regardless of temporal period (Cardenas and Van Wormer 1984).

Late Prehistoric Period

The Late Prehistoric period began approximately 1,500 years ago when Yuman- and Shoshonean-speaking people entered the San Diego region from the Colorado River basin (Smith 1996). Known locally as the Diegueño, or Kumeyaay culture, settlement during this period appears to have been more intensive and the exploitation of local resources more efficient (Kyle et al. 1996). Cultural patterns of the Kumeyaay include small, pressure-flaked projectile points, milling tools including mortars and pestles, scrapers, beads, hammerstones, ceramics, and semipermanent or permanent seasonal village sites (Kyle et al. 1996; Smith 1996). Additional manifestations of the

Late Prehistoric period include an increased use of seeds, berries, and bulbs, the hunting of small game, the use of obsidian, and cremations. The culture of the Kumeyaay appears to be closely related to the religious beliefs and trade associations of groups living in the Colorado River basin (Kroeber 1925).

Coastal manifestations of the Kumeyaay differ from the inland counterparts. Fewer projectile points are found on the coast, and there tends to be a greater number of scrapers and scraper planes at coastal sites (Robbins-Wade 1986, 1988). Cobble-based tools, originally defined as "La Jolla," are also characteristic of coastal sites of the Late Prehistoric period (Cardenas and Robbins-Wade 1985:117; Winterrowd and Cardenas 1987:56). The Late Prehistoric period in this region ended as contact with the first of the Spanish explorers—Juan Rodriguez Cabrillo—was made in 1542.

Historic Period

The prehistoric period in Southern California ended with Spanish exploration and settlement in the early 1500s. The Historic period is characterized by several distinct stages. These, originally defined by Chartkoff and Chartkoff (1984), are summarized in the following discussion (from Buysee and Largent 1999).

Exploration Period (1539-1769)

Starting in 1539 and over the next 250 years, California was visited by Spanish, British, and Russian explorers, and by traders and trappers, from the Spanish colonies to the southwest or from naval expeditions sent to explore the Pacific coast. In 1539, a detachment of Coronado's expedition from northern Mexico reached the Colorado River. Several years later, in 1542, a Portuguese navigator named Juan Rodrigues Cabrillo leading a Spanish expedition became the first European to arrive at San Diego Bay. Cabrillo sailed as far north as Cape Mendocino in Northern California in search of a northwest passage to link the Atlantic and Pacific. He died during the journey and was buried on San Miguel Island, off the coast of Southern California. During the next two centuries, Spanish expeditions to California were limited, primarily due to Spain's focus on politics in Europe and on the Manila trade.

The British navigator Sir Francis Drake reached California in 1579, making his way north along the coast to Point Reyes in Northern California. The British did not follow up on Drake's expedition and therefore had no further impact on the native cultures beyond the trading that was conducted during that voyage.

Threatened by the British expedition, Spain conducted two further expeditions to California in 1597 and 1602 headed by Sebastian Rodriguez Cermejo and Sebastian Vizcaino, respectively. The purpose of these journeys was to find a favorable harbor in which to establish a settlement. The first voyage ended with the ship being destroyed and the crew returning to Mexico in a small open boat without having located a suitable harbor. The second expedition discovered the bay at Monterey, but due to political troubles, the plans for colonizing California were abandoned by Spain.

During the next 150 years, California was largely neglected by explorers. Occasional trading ships from Spain and Asia found their way to shore, resulting in limited trading between these groups and the native cultures. Research has identified a decline in native populations during this time, perhaps due to diseases introduced by the Europeans. Whatever the cause, this decline was confined primarily to the native cultures living along the coast. Otherwise, historical accounts indicate there was little contact between Europeans and the native cultures of California and, thus, relations appear to have been relatively amicable.

Spain's interest in California peaked again in the late seventeenth century. Spain launched an effort along with the Jesuits to establish a chain of missions and military outposts among the native cultures of California. In 1769, Gasper de Portole, then governor of Baja California, lead a combined land-sea expedition north to begin settlement of California. Generally, the period had little impact on the archaeological record in California, with the exception of a few Spanish artifacts and Chinese porcelains. One of the important contributions of this period in terms of the history of California is the collection of diaries and journals kept by the early explorers of this region.

Hispanic Period (1769-1822)

Portole's expedition landed at San Diego in 1769. The program developed by Jose de Gelvez, who had taken over the colonial government in Mexico City several years earlier, included the establishment of three different institutions: military garrisons - or presidios; religious agrarian institutions - or *misiones*; and civilian settlements and ranches - or pueblos and ranchos. The program was intended to create a gentry consisting of independent farmers, ranchers, and merchants, administered by local officials under the authority of the Spanish king. They would also serve as a militia in resisting Russian and European expansion and were prevented from having commerce with other powers. The religious missions were made the center of the colonizing effort. Over the next 52 years, 21 missions were established between San Diego and Sonoma, four military presidios were established (including one at San Diego), and two formal pueblos were built. Settlement was concentrated along the coast because it was easily defendable and was an area in which native populations were dense. By 1822, the nonnative population in California was 3,750 people.

Mission San Diego de Alcale was established on July 16, 1769, on the bluffs just above San Diego Bay; the presidio was established adjacent to the mission shortly thereafter. Native peoples were brought to the missions as laborers to build the missions and associated structures, and while there, learned skills such as brick-making, ceramic-tile manufacture, weaving, baking, cultivation, and ranching. Tensions were high; death rates increased due to disease, while malnutrition, abuse, and culture shock were common at the missions. Several years after its construction, the San Diego mission was moved from its location near the bay to approximately five miles inland due to hostilities between the occupants of the mission and the military personnel of the presidio. In 1775, a group of Native Americans attacked and burned the San Diego mission, which was later rebuilt. After 1810, the mission populations throughout California declined rapidly. Although Spain had succeeded in settling California, the mission program failed to create the population envisioned. In 1821-1822, Mexican revolutionaries overthrew the Spanish government and an independent Mexican nation was created.

Little is known about the archaeology of Spanish-period sites in the Lower Rio Grande Valley, although historical accounts do document the presence of one Native American settlement, Millejo Village, within the USIBWC project corridor. Millejo Village, site SDI-10669, is a Kumeyaay village that was located on the Tijuana River floodplain approximately km east of the Pacific Ocean (Carrico 1993; Higgins et al. 1994a:17). The village was occupied between 1770 and 1822 A.D., but no absolute traces of it have been found archaeologically. Carrico (1993) and Shipek (1976) argue that the site is probably buried under Tijuana River alluvium, some of which could be associated with extensive floods that occurred in the lower valley in 1895 and 1916. While several isolated finds have been reported near site CA-SDI-10699, little remains of the site itself according to the site form on file at the South Coastal Information Center, San Diego State University.

Mexican Period 1822-1846

The shift from Spanish to Mexican civil and military authority introduced several important changes in California. First, Mexico relaxed the restriction on trade between California and other nations, particularly with England and the United States in the form of cattle by-products. Because the sudden emphasis on cattle placed a heavy burden on the missions, this trade was passed on to the rancheros. This increase in trade brought to the larger communities such as San Diego commercial agents who brought with them the first commercial banking institutions. Second, the exploration and exploitation of California by fur trappers brought many of the first direct contacts between foreigners and native groups of the interior. The introduction of diseases was devastating to native groups, such as the smallpox epidemic of 1830-1833 in the Sacramento valley, which may have killed as many as 60,000 Native Americans (Chartkoff and Chartkoff 1984). Third, although the process was started before the Mexican Revolution, the secularization of the missions was accelerated under Mexican rule, including plans to grant Mexican citizenship to all persons born within the republic. However, several problems complicated the issue. The mission padres were often of Spanish birth and showed little support for the Mexican government. Furthermore, the Native Americans who had been living in the missions were resistant to the idea of leaving.

Jose Figueroa, the governor of California, planned to turn over half of all mission lands, herds, and machinery to the Native Americans, the other half being administered by the appropriate towns. However, most of the available land was given over to a handful of Mexican families along with vast herds of sheep, cattle, and horses (Chartkoff and Chartkoff 1984). Two ranchos were located in the Otay Mesa region, Otay Rancho and Janal Rancho; these were granted to members of the Estudillo family in 1828 (Schilz 1989). Rancho Milijo was located at the western edge of Otay Mesa and was granted to Santiago Arguello in about 1830 (Schilz 1989). This area of San Diego was primarily used for cattle grazing activities, until the shift from cattle grazing to cultivation occurred in the 1850s. In 1846, Mission San Diego de Alcale and more than 58,000 acres of land were granted to Santiago Arguello. Many of the mission Native Americans ended up as laborers on these Mexican rancheros. A number of Mexican-era rancherias are recorded in the San Diego area. These include sites in the New Town Middletown, and Balboa Park areas (Carrico 1987b74-88; Higgins et al. (1994a:18).

Anglo-American Period 1846 to the Present

As the only port in Southern California, San Diego was of strategic importance to both Mexico and the United States. In 1846, California was seized by United States troops and declared an American territory. The non-Native American population of San Diego at this time was about 350 people, most of whom lived in what is now called Old Town, approximately three miles north of present-day downtown San Diego. By the time the town of San Diego was established, at least 20 permanent or semipermanent villages had been established in the region (Smith 1996).

Two years later, gold was discovered in Northern California. Over the next few years, thousands of miners and explorers poured into Northern California. California was made a state in 1850. Previously, the governing of territories had been informal with missions and the military exerting local control. Statehood brought the division of California into counties with their own governments with multiple branches. The complex governing system introduced to the state, along with the presence of the federal government and agencies, brought a new political structure and organization to California.

In 1852, the state's non-Native American population had reached 225,000, while the Native American population had fallen to less than 100,000 (Chartkoff and Chartkoff 1984). Although the total population of the state was approximately the same as it had been 100 years earlier, the characteristics of the population were completely different. The subsequent effects of statehood also brought about increased urbanism; where Monterey had been the primary port under Mexican rule, other towns, including San Diego, experienced increased development. In the 1850s, developments in transportation such as steam ships and extensive road systems tied these towns together. In 1867, Alonzo Erastus Horton, a settler from Wisconsin, proposed to move the town of San Diego three miles south of Old Town to its present location (Chartkoff and Chartkoff 1984). The new town became an important naval port, and the suburbs around San Diego became popular tourist destinations. The "No Fence Act" of 1872, which allowed for the expansion of unfenced farms, supported a shift in land use from primarily pastoral to agricultural (Kyle et al. 1996). Between 1885 and 1887, San Diego County experienced an economic boom, during which Otay Mesa was promoted by speculators who owned portions of the mesa as a potential agricultural land waiting for development (Schilz 1989). Rural communities appeared and disappeared throughout San Diego County during this period. Soon after, a railroad built over the mountains east of San Diego finally linked the city to other communities to the north and east, further increasing the urbanization of San Diego.

Archaeological sites associated with the historic Anglo American period in the general project area include building remains, historic trash scatters, and World War II military sites. Historic materials associated with the Imperial Beach Naval Air Station have been reported from landfill localities within the Tijuana River floodplain (Higgins et al. 1994a:19). In addition, a World War II artillery shore battery is recorded from Spooners Mesa, which is located immediately south of the current project corridor (Higgins et al. 1994a:19).

CHAPTER 4
PREVIOUS RESEARCH AND DATA COMPILATION

by

Victor Gibbs and David D. Kuehn

Previously recorded site data were compiled from the online New Mexico Archaeological Records Management Section (ARMS), the Texas Archeological Research Laboratory (TARL), and the California Historic Resources Information System (CHRIS), as well as from various cultural resources reports. Cultural resources overviews for the Rio Grande Canalization Project (Brown et al. 2001) and Rio Grande Rectification Project (Brown et al. 2003) conducted for the USIBWC were used as secondary sources of information. Holliday and Ivey (1974) and Cloud (2004) were used as a reference for the Presidio area, and Cooper et al. (2003) was referenced for the Lower Valley Flood Control Project region. Buysse et al. (1999) and Higgins et al. (1994a) were used as references for the Tijuana River segment.

The data were compiled into a tabular format by river segment and county (Appendix A). This appendix includes the USGS topographic quadrangle map the site is found on, the site number and name (if any), the UTM location (if known), temporal affiliation, the geomorphic setting, size, artifacts and features, the phase of work conducted on the site, the NRHP eligibility of the site, if known, and report references (if any) for the site. Site locations were divided into two landform categories: floodplain and terraces. The terrace category includes areas of distal alluvial fans, but it is difficult to determine terrace landforms from fans based solely on the examination of topographic maps.

The availability of previously recorded site information varies by state organization, and thus is not always consistent or complete for each of the tables. The site search focused on a one-half mile distance on either side of the Rio Grande and the Tijuana River. Only sites within the United States were identified. Specific or significant projects and cultural properties relating to each section of the river are detailed below.

RIO GRANDE CANALIZATION PROJECT AREA

A cultural resources overview for this area was completed for the USIBWC (Brown et al. 2001), which provides a detailed analysis of the segment of the Rio Grande between Percha Dam, New Mexico, and American Dam, in Texas. The project included a reconnaissance survey, backhoe trenching along pertinent sections of the river, a previously recorded site table extending one mile from both sides of the river channel, an annotated bibliography of previous projects, and a large section on geomorphology for predicting site locations. Brown and others (2001:31) found 186 sites in the two-mile wide corridor, including 130 prehistoric properties, and 56 historic properties. Eighteen NRHP and/or New Mexico State historic listed properties were identified.

Within the one-mile corridor searched during the current Geo-Marine effort, 122 cultural properties or districts were identified (Appendix A, Table A.1). Of those, 34 are eligible for the NRHP. Sixteen of the sites are listed on the New Mexico State register and six of those sites are listed on the National Register of Historic Places (NRHP).

The majority of the previously recorded prehistoric sites in this portion of the project have been identified on the river terraces and fans, because flooding and human activity have obscured or erased most evidence of prehistoric use in the surface or near surface portions of the floodplain. A summary of the temporal affiliation of the cultural properties comparing floodplain and terrace sites is provided in Table 4.1.

Table 4.1.
Summary of Cultural Resources within One Mile
of the Rio Grande Canalization Project (n=123)

Temporal Affiliation	Floodplain	Terrace/Fan	Total
Paleo-Indian	0	0	0
Archaic	0	3	3
Formative	17	44	61
Historic	24*	7*	28
Multicomponent Archaic/Formative	1	2	3
Multicomponent Prehistoric/Historic	4	7	11
Unknown Temporal Affiliation	6	9	15

* one site in both floodplain and terrace

Though most of the sites are associated with the Formative period, 48 of them within the half-mile corridor were recorded in the 1930s and 1940s by amateur archaeologist Herbert Yeo. The majority of Yeo's sites were recorded partially because of the presence of ceramics and the researcher's interest in the Formative period. These sites were originally plotted on 15-minute topographic maps and have been found to have poor location accuracy when marked on the 7.5-minute maps. No report of Yeo's work has ever been completed, though his records are on file at ARMS. Other early work along this section of the Rio Grande was conducted by Lehmer (1948), during his groundbreaking chronology sequence of the Jornada Mogollon region. Other significant work along the river includes Lekson's (1984, 1989) reconnaissance surveys of Sierra County and O'Laughlin's (1980) work at the Keystone Dam Site.

Some significant projects, presented by temporal period, are identified below, beginning with Percha Dam (upstream) and ending with American Dam (downstream). Significant Archaic period sites within the Rio Grande Canalization project include one habitation site (LA [Laboratory of Anthropology] 50743) near Percha Dam, which contains four pithouse structures (Lekson 1984). Another Archaic site (LA 5220) located near Las Cruces is Chavez Cave, which contains Middle and Late Archaic, as well as early Formative period components (Cosgrove 1947). A survey of 210 acres was conducted on USIBWC lands between Percha Dam and Mesilla Dam and only one site (LA 107943) was documented (Adams 1995).Several important Formative period habitation sites have been documented along this segment of the river, including site LA 517, a prehistoric village with 15 habitation structures. Other sites in the vicinity that contain structures include LA 50743, LA 50745, LA 50746, LA 50749 (Rio Vista Ruin #2), and LA 50751 (Lekson 1984), as well as other sites in the area (Lekson 1989). The nearby Garfield Site (LA 1082), reported to contain 10 structures, was excavated during a 1973 New Mexico State University field school, and later reported on by Mayo (1994).

Further downstream, the Hatch Site (LA 3135), is a multicomponent village excavated in 1964 for the New Mexico State Highway and Transportation Department (Schaafsma 1964, 1990). Site LA 106780, an early and late Formative village near the Leasburg Diversion Dam, was excavated by SWCA, Inc. (Polk et al. 2000) and Statistical Research, Inc. (Wegener 2003). Two excavation projects have been conducted at LA 854, in which two pithouses and a burial were discovered (Etchieson 1987; Knight et al. 2004). Site LA 15315 (Los Tules), was excavated in the 1940s and was deemed the type-site for Mesilla phase pottery (Lehmer 1948).

Near El Paso, Texas, site LA 1644 (Cristo Rey Site) one prehistoric structure was documented (ARMS files). Site LA 98732 (Sandy Bone Site) is reported to contain structures (O'Laughlin and Gerald 1977). La Cabrana Pueblo (LA 1671) was first discovered by Herbert Yeo in 1932 and was further studied by O'Laughlin (1980), Foster and others (1981), and Bradley (1983).

Fort Thorn (LA 8772), occupied between 1853 and 1859, and Fort Selden (LA 859), occupied between 1865 and 1891, are two historic military forts that are within one-half mile of the Rio Grande within this portion of the project. No remains are extant at Fort Thorn; however, many of Fort Selden's walls remain, and it is a New Mexico State Park.

The properties that may be directly affected by future proposed construction along this segment of the river are all Historic period structures and include Percha Diversion Dam (no number), Gonzalez Lateral (LA 111730), Garfield Canal (LA 111733), Arrey Canal (LA 111734), Percha Lateral (LA 111736), Tonuco Drain (LA 120257), Leasburg Diversion Dam (LA 106783), Leasburg Canal (LA 117295; Poague et al. 1995), the Rio Grande bridges at Highway 85 and 185 (no numbers), Leasburg Drain (LA 112604), Shalem Drain (LA 112609), Mesilla Diversion Dam (no number), Southern Pacific Railroad Bridge (LA 114176), Rio Grande Railroad Bridge (LA 127181), and the American Diversion Dam (no number). In addition, any work conducted along this segment is considered part of the Elephant Butte Irrigation District. Any acequia over 50 years old may be considered eligible for inclusion in the NRHP, even if it has not yet been formally recorded.

RIO GRANDE RECTIFICATION PROJECT AREA

A cultural resources overview for this area was completed for the USIBWC (Brown et al. 2003), and provides a detailed analysis of the segment of the Rio Grande between American Dam and Fort Quitman, Texas. This project included a reconnaissance survey, backhoe trenching along pertinent sections of the river, a table of previously recorded properties extending one mile from the north side of the Rio Grande river channel, an annotated bibliography of previous projects, and a large section on geomorphology for predicting site locations. Brown and others (2003:30) found 205 sites in the one-mile wide corridor north of the Rio Grande channel.

During the current effort, within the American Dam to Fort Quitman segment of the Rio Grande, 60 cultural properties have been documented within one half mile of the north side of the river (Appendix A, Table A.2). Twenty-seven of the locations within one-half mile of this segment of the river are National Register properties or districts associated with the city of El Paso, Texas. National Register historic districts include the Sunset Heights Historic District, El Paso County Water Improvement District #1 (Mosely 1978), and the San Elizario Historic District. The National Register properties are predominantly significant historical buildings concentrated in downtown El Paso, Texas, but also include the Franklin Canal.

Significant archaeological work conducted within this segment of the river includes a project conducted by Staski (1984, 1985), prior to the construction of the Cortez Hotel. This project identified historic remnants of El Paso's Chinatown, which was inhabited between 1883 and 1915. Other work conducted in the area has taken place near the towns of Ysleta (Miller and O'Leary 1992, Weedman 1993a), and Socorro, Texas (Brown et al. 1994, Weedman 1993b).

Two of the three prehistoric properties identified by the search in this portion of the project are large, Formative period habitation sites near Fort Quitman (41HZ16, 41HZ491). The other is a possible Formative period site in El Paso (41EP2841; Anthony et al 1992). Site 41HZ16 is a Late Archaic period camp, with a historic component (Johnson 1977). Site 41HZ491 (Lucky Devil Site) is a late Formative period property that may contain the first identified prehistoric agricultural irrigation features along the Rio Grande in Texas (Hubbard 1992).

Five of the properties near Ysleta, Texas, and 15 near San Elizario, Texas, are existing historic homes or home sites. One of these, the Dindinger Homestead (41EP2981) is listed on the National Register. Many of these structures were recorded during architectural inventories of the Ysleta and San Elizario area by Hicks and Company (Weedman 1993a, 1993b). Some of these architectural properties were later examined by Kammer (1998).

Three historic fort sites are located along this segment of the Rio Grande. One is the original site of Fort Bliss and Hart's Mill (41EP37), located just downstream from American Dam. Hart's Mill was established in 1850; it is one of the oldest buildings in El Paso. Fort Bliss was located at this site between 1878 and 1893, when it was forced to move because of conflicts with the railroad. Two officers quarters remain of the post, and are currently used as apartment buildings (Metz 1988:59-64; USDI 1965). The original site of Fort Hancock (41HZ242) is located within the corridor, which consists of a historical marker overlooking a plowed field. The fort was occupied from 1881 to 1895 (Kohout 2005). Fort Quitman (no number available) was occupied between 1858 and 1861, vacated and reoccupied in 1868, vacated in 1877, and reoccupied between 1880 and 1882 (Whitsett 1977; Dinges 2005).

One large project that has been conducted along this segment of the Rio Grande included the construction of the Samalayuca Natural Gas Pipeline, which transects through the vicinity of Ysleta and San Elizario. Several linear irrigation features were crossed during the construction of the 21-mile pipeline, including the Riverside Canal (41EP4679), the River Spur Drain (41EP4675), and the San Elizario Lateral (41EP4677; Evaskovich and Higgins 1993).

Only three properties in the Rio Grande Rectification Project are located on the terrace, including the Sunset Height Historic District, the El Paso Union Passenger Station, and site 41EP497 (unknown temporal affiliation). The remaining properties are located on the floodplain.

Properties that may be directly affected by possible construction activities may include the El Paso Water Improvement District No. 1 (USDI 1997), Old Fort Bliss/Hart's Mill (USDI 1965), Franklin Canal (USDI 1992), the Chamizal National Memorial (USDI 1973), Riverside Canal, the River Spur Drain, and the San Elizario Lateral. Any acequia over 50 years old may be considered eligible for inclusion in the NRHP, even if it has not yet been formally recorded.

PRESIDIO-OJINAGA FLOOD CONTROL PROJECT AREA

Twenty-seven cultural properties have been identified within this section of the Rio Grande approximately six miles up and down stream of the town of Presidio, Texas. (Appendix A, Table A.3) Nineteen of the sites contain a Historic period component, and six sites contain a Formative (Late Prehistoric) component. Three sites contain an unknown prehistoric component. Four sites in the database contain no data other than a map location (41PS86, 41PS87, 41PS88 and 41PS423).

All but three of the sites (41PS86, 41PS87, 41PS89) are located on river terraces overlooking the Rio Grande floodplain to the south. None of the sites are within the vicinity of existing levees and should not be impacted by future construction activities.

Because the intersection of the Rio Grande and the Conchos River is within this section of the project area, this region has been studied by numerous researchers, including J. Charles Kelley, beginning in 1933 and lasting throughout his life (Kelley 1933, 1939, 1947, 1952a, 1952b, 1953, 1957, 1985, 1986). His work largely defined the cultural sequences within this portion of the Trans-Pecos region (see Chapter 3). Four sites documented by Kelley that are within one-half mile of the Rio Grande, including sites 41PS14/41PS67, 41PS15, 41PS16, and 41PS23. The most significant prehistoric sites within the project corridor search area are 41PS14/PS67 (the Millington Site) where Kelley excavated 22 historic Native American pueblo structures in 1936 and 1937, and the 41PS15 (the Loma Alta Site), in 1938 and 1939 (Kelley 1939, 1947). The Loma Alta Site contained the remains of 56 structures, as well as ring midden features, and numerous artifacts (Holliday and Ivey 1974).

Site documentation work was conducted by Edward Jelks in 1969 on sites 41PS60 – 41PS71, but no report was completed (TARL files). In 1973 and 1974, a cultural resources evaluation was conducted to determine potential impacts of the Presidio-Ojinaga Flood Control Project (Holliday and Ivey 1974). During their work, they revisited several of the sites documented by Kelley, but found no sites within the channel relocation area (Holliday and Ivey 1974:19). Additional work was conducted by Johnson (1977), as part of a large evaluation of sites by the El Paso Centennial Museum along the Rio Grande between Fort Quitman and Presidio, Texas. Sites 41PS358 – 41PS364 were documented in the Presidio area.

Currently, the only significant Historic period site of note is Fort Leaton (41PS18), a private fort built by Ben Leaton in 1848, on the site of a former Spanish fort occupied between 1877 and 1810. Leaton ran a trading post, chapel, and farm at the fort until his death in 1851, when the mortgage holder, John Burgess, took possession of the property. In 1934 and 1935, the fort was partially restored and a historic marker was established, and in 1967, it became a Texas State Historic Site (Smith 2005, Texas Parks and Wildlife Department 1993). In 1971, excavations were conducted at the site (Ing and Kegley 1971), and in 1973, further excavations were conducted at the chapel (Ing and Robertson 1974).

LOWER RIO GRANDE FLOOD CONTROL PROJECT AREA

A cultural resources overview for this area was completed for the USIBWC (Cooper et al. 2003), and provides a detailed analysis of the segment of the Lower Rio Grande Flood Control Project. This project included archival research, a reconnaissance survey, backhoe trenching along pertinent sections of the river, and a table of previously recorded properties extending one mile from the north side of the Rio Grande river channel. The report documented previously recorded prehistoric sites in Cameron, Hidalgo, and Willacy counties.

The earliest archeological work to be conducted in the area was by A. E. Anderson, a civil engineer from Brownsville, Texas. Between 1908 and 1940, Anderson recorded information on several hundred sites and collected artifacts from both sides of the Rio Grande (Zavaleta 1987). Anderson's collection has served as the basis for most of the later archeological interpretations of the area.

In 1947, Richard S. MacNeish built upon the work of Anderson and Sayles, publishing a paper on regions in coastal Tamaulipas, Mexico, and the lower Rio Grande valley. He described three complexes, based on surface assemblages, pertinent to South Texas: Brownsville, Abasolo, and Repelo (MacNeish 1947:2-3).

Archeological work since the 1970s has included primarily reassessments of previous efforts and survey projects. In 1976, a survey was conducted by the Texas Historical Commission for a proposed USACE floodwater channelization project in Hidalgo and Willacy counties (Mallouf et al. 1977). The project documented 49 archeological sites and provided predictive environmental-cultural modeling for future work. A second, similar project was carried out by Prewitt and Associates, Inc., for the USACE in Hidalgo and Willacy counties in 1980, documenting 63 sites (Day et al. 1981). Smaller surveys, including Bousman et al. (1990), Boyd et al. (1994), Hall and Grombacher (1974), Kibler and Freeman (1993), and Zavaleta (1987) have added to the body of knowledge existing within this region.

An overview of the existing data base and pertinent research questions for the lower Rio Grande valley (Black 1989) were provided as part of a larger study of human adaptation in South Texas (Hester et al. 1989), sponsored by the Southwest Division of the USACE in the mid-1980s. More recently, Phase II test excavations of prehistoric sites in Hidalgo and Willacy counties (Bousman et al. 1990), limited excavations at 41WY50 and 41WY60 (Kibler 1994), investigations related to the Pharr-Reynosa International Bridge (Boyd et al. 1994), and investigations of the Tomates Bridge area (Rogers 1996 and Rogers and Cruse 1996) have provided the lower Rio Grande valley with preliminary, but much needed, geomorphic information.

Of the 68 properties within one-half mile of the Rio Grande in the LRGFCP, only one site contains a prehistoric assemblage (41HG153; Appendix A, Table A.4). This site is in a plowed context and is a surface scatter containing a projectile point, mussel shell and bone, as well as historic ceramics and metal. Backhoe trenches revealed additional shell artifacts at a depth of 30 cm, possibly indicating an older surface (Kibler and Freeman 1993).

The remaining properties are Historic period homes, home sites, campsites, plazas, plantations, cemeteries, ranches, as well as a collection of unknown assemblages. Four National Register districts are present near the Rio Grande, including the La Lomita Historic District (1875-1924), the Louisiana-Rio Grande Canal Irrigation System in Hidalgo County (1900-1949), the Fort Brown District (1825-1924), and the Palmito Ranch Battlefield District (1865) in Cameron County. Historic archaeological excavations have been conducted at the site of historic Fort Brown (Carlson et al. 1990; Pertulla et al. 1997; Marcum 1964; Moir et al. 1993; and Sides (1942). In addition, excavations and construction monitoring were conducted at Fort Brown in 1995 and 1998 (Hartmann et al. 1999), revealing significant information on the fort's trash dumps.

Two prominent historic battlefield sites, the Palo Alto and Resaca de la Palma Battlefields, are located near, but not within, the current project corridor. Both were the setting of important battles during the Mexican/American War and both have been the objects of professional archaeological investigations (Bond 1979; Haecker and Mauck 1997; Collins et al. n.d.; Hester 1978).

Several National Register properties are also within one-half mile of the river, including the Old Hidalgo Courthouse Building (1875-1899), Old Hidalgo School (1900-1924), and Rancho Toluca (1875-1924) in Hidalgo County. Historic Register properties in Cameron County include The Gem (1848, 1864), Augustine Celaya House (1911), Charles Stillman House (1850), La Nueva Libertad (1875-1924), Miguel Fernandez Hide Yard, Old Cameron County Jail (1900-1949), and Cameron County Courthouse (1900-1924) (Appendix A, Table A.4).

Properties that could be impacted by future work that are in the immediate proximity of the Rio Grande include (from upstream to the Gulf of Mexico): the La Lomita Historic District, and Louisiana-Rio Grande Canal Irrigation System in Hidalgo County and sites 41CF169, 41CF170, 41CF171, 41CF95 41CF96 (Fort Brown), 41CF129, 41CF177, Fort Brown Historic District, the Brulay Plantation, 41CF108, 41CF112, Palmito Ranch Battlefield District, 41CF6, and 41CF5 in Cameron County.

INTERNATIONAL TIJUANA RIVER FLOOD CONTROL PROJECT AREA

Within the one-half mile corridor of the Tijuana River, 20 cultural properties have been previously documented, including 17 prehistoric sites and three historic sites (Appendix A.5). Because of the floodplain/estuary environment along this section of the Tijuana River, most of the prehistoric properties have been identified within plowed fields, road cuts, or other subsurface contexts of up to 7 meters deep. As such, any modification to the Tijuana River channel may encounter buried cultural deposits. Based on the substantial frequency of sites on the surrounding terraces above the river, as well as the diverse and sometimes large artifact assemblages associated with the sites within one-half mile of the river, there is little doubt that the area was heavily utilized during the prehistoric period.

Most of the sites within the current project area were identified during small-scale surveys conducted for industrial facilities, transportation, utility projects, and maintenance activities associated with patrolling the international border. The larger reports in the vicinity of the project area include: Adams and Turnbow (1994), Alter et al. (1992), Carrico (1974, 1976), Cheever and Gallegos (1987), Cook and Pallette (1994), Doolittle et al. (1997), Gallegos et al. (1986), Higgins and Acklen (1991), Higgins et al. (1994a), IBWC (1987), Polan (1981), and RECON (1983). Projects located within the one-mile corridor are detailed below.

Three sites were documented during trench monitoring for a wastewater treatment pipeline prior to the construction of a wastewater treatment facility (Higgins et al. 1994a, 1994b; Adams and Turnbow 1994; Turnbow et al. 1995). Site CA-SDi-13487 was identified at a depth of 1 meter, and contained fire-cracked-rock with charcoal, a chopping stone, and shell fragments. Site CA-SDi-13488 was found at a depth of 3 meters, and contained two fire-cracked rock features and artifacts over a 120-meter length. Radiocarbon dating of the two features yielded dates of 3494 B.C. and 5045 B.C. (Higgins et al. 1994a).

Site CA-SDi-10669F was previously documented by Shipek (1976) as the probable location of Millejo Village, a Kumeyaay habitation site, ethnographically documented by the Spanish in 1769 and abandoned by 1850. No surface indication of the village exists, and it was suggested that the Tijuana flooding events of 1895 and 1915 might have buried or destroyed the site (Shipek 1976) and subsequent work has failed to locate any subsurface remains of the village (Gallegos et al. 1986). During Higgins and others (1994a) work, fire-cracked rock features were identified at 6 and 7 meters below the ground surface, and Feature 1 returned a radiocarbon date of 2739 B.C. Several other isolated areas along the trench within the presumed site boundary also contained cultural debris, but were interpreted as redeposited artifacts.

In 2002, Laguna Mountain Environmental, Inc., documented a large buried shell midden on the southern bank of the Tijuana River. The site (SDi-16293) is buried below 2 meters of alluvium and reaches a depth of at least 3 meters below the ground surface (Pigniolo 2002).

Several project have been conducted on the eastern portion of the Tijuana segment, including a large survey for San Ysidro (Kyle et al. 1996), as well as smaller surveys (Hanna 1977; Kyle 2000; City of San Diego 1994; Smith et al. 1993; and Robbins and Schultz 1996). Only one site was documented within all of the surveys of the eastern section within one-half mile of the river channel (SDi-4934/SDi-12962). This site has been documented in two locations and was later given an additional site number. The site contains prehistoric artifacts with deposits to a depth of 180 cm, as well as historic materials (Hanna 1977; Smith et al. 1993).

Historic sites within one-half mile of the Tijuana River include the concrete and stone remains of an 1898 structure (SDi-10488), a ca. 1915 farmhouse (SDi-12023; Manley 1993), and the Hollister Street Bridge (SDi-17240), which crosses the Tijuana River (Steely 2004).

Cultural resources that may be impacted by proposed work in the direct vicinity of the Tijuana River include SDi-4934/12962, SDi-17240 (the Hollister Street Bridge), SDi-10669 (Millejo

Village), SDi-17098, SDi-10967, and SDi-16923. Because of the floodplain/estuary environment, the potential for subsurface deposits to a depth of 7 m is possible.

PREVIOUS GEOARCHAEOLOGICAL RESEARCH

Projects integrating geology, geomorphology, and archaeology have been undertaken for USIBWC-related research in the Percha Dam to American Dam, American Dam to Fort Quitman, Lower Rio Grande Valley, and Tijuana River Valley areas (Gallison and Wilcox 2001; Cooper et al. 2003; Frederick and Higgins 1993; Brown et al. 2003; Higgins et al. 1994a). There have also been a number of geoarchaeological studies for non-USIBWC projects along portions of the Rio Grande from south of Las Cruces, New Mexico to Brownsville, Texas (Bousman et al. 1990; Gustavson and Collins 1998; Hall 1994; Kuehn 2004; Kuehn et al. 2004; Keller 1995; Young et al. 1999). These efforts have tended to focus on identifying and dating the various landforms associated with archaeological sites, establishing local geochronologies, documenting site stratigraphy and soils, and reconstructing non-cultural site formation processes. The more substantive of these geoarchaeological research efforts are summarized in the following discussion.

Rio Grande Canalization Project Area

Gallison and Wilcox (2001) conducted geomorphic investigations at 10 localities between Percha Dam and American Dam. The goal of the research was to develop an alluvial chronology for the Rio Grande floodplain that could be used to identify archaeological site potential. A chronological summary of Holocene floodplain development was constructed utilizing backhoe trench and cutbank stratigraphy and a series of 11 radiocarbon ages. As stated previously, all of the radiocarbon ages were determined from soil humates (Gallison and Wilcox 2001). In all but three of the 10 study areas, investigations were limited to the modern Rio Grande floodplain. In the remaining three, portions of adjacent alluvial fans were also investigated (Gallison and Wilcox 2001). The radiometric data led the authors to conclude that fine-grained alluvial sediments comprising the upper ca. 1.0 m of the Rio Grande floodplain fill were deposited within the last ca. 2,500 years (Gallison and Wilcox 2001:111).

Outside of the current floodplain, Kuehn and others (2004) examined three Archaic/Jornada Mogollon sites on a low alluvial fan above the Rio Grande near Berino, New Mexico. The sites were buried under Historic period sand dunes and directly associated with late Holocene sand sheet deposits (Mesilla phase component) that were underlain by late-middle Holocene alluvial fan sediments (Archaic component). The investigations were augmented by backhoe trench excavations and the procurement of two radiocarbon dates obtained from charcoal samples collected from archaeological contexts. Late Archaic pithouse structures in fine-grained alluvial deposits yielded charcoal radiocarbon ages of 4080±40 yr B.P. and 3550±40 yr B.P. Diagnostic artifacts (ceramics) associated with the Mesilla phase component in a buried A horizon soil formed in eolian sand sheet deposits date from ca. 1800 to ca. 900 yr B.P. and provide at least a relative age for the period of soil formation that followed deposition of the eolian sand sheet sediments.

Rio Grande Rectification Project Area

A Class I cultural resource survey and geoarchaeological investigations were conducted for the USIBWC Rio Grande Rectification Project in El Paso and Hudspeth counties, Texas, by

Ecosystems Management, Inc., (Brown et al. 2003). The study included the excavation of 42 backhoe trenches in 13 localities between Socorro, New Mexico and Fort Quitman, Texas. The localities were situated at the site of former meander scars, as well as several adjacent alluvial fans and arroyos. The research was conducted to facilitate prediction of where archaeological sites were likely to be located (Brown et al. 2003:51). The temporal framework for the study was provided by the procurement of 21 radiocarbon ages. Seventeen of these were obtained from samples of organic sediment, while four were obtained from charcoal samples.

The four charcoal samples were collected from a single backhoe trench that was located in a narrow portion of floodplain (Locality 8) at depths that ranged from 0.50 to 0.95 m below the surface. The samples yielded ^{14}C dates that ranged from zero to 310±50 yr B.P. (Brown et al. 2003:60-61). Three additional radiocarbon ages from trenches at Locality 8 were obtained from organic sediments located at depths similar to those of the charcoal samples. These bulk low carbon samples yielded ^{14}C dates that ranged from 110±60 yr B.P. to 410±50 yr B.P. (Brown et al. 2003:60-61).

Twelve of the remaining 14 organic sediment samples analyzed during the course of the project yielded radiocarbon dates older than 600 yr B.P., with the oldest age being 2430±80 yr B.P. (Brown et al. 2003). At Locality 3, six radiocarbon ages were obtained from organic floodplain and possibly distal alluvial fan sediments that were located from 0.50 to 0.95 m below the surface. These dates ranged from 620±50 yr B.P. to 2330±40 yr B.P. (Brown et al. 2003:57-58). At Locality 6, located in a wide portion of the Rio Grande floodplain, six radiocarbon ages from two backhoe trenches were obtained on samples of organic sediment. These were collected from fine-grained alluvial deposits at depths ranging from 0.50 to 0.95 m below the surface (Brown et al. 2003:59). The samples of bulk low carbon yielded ^{14}C ages ranging from 2010±60 yr B.P. to 2430±80 yr B.P. (Brown et al. 2003:59). Brown et al. (2003:67-68) argue that the radiocarbon ages run on bulk low carbon samples are internally consistent and provide an accurate geochronologic framework for late Holocene floodplain aggradation in the areas studied.

Similar, but more limited, research into the age and geomorphic history of the Rio Grande floodplain near El Paso, Texas was conducted by Frederick and Higgins (1993). Their investigations centered on a single point bar along the modern Rio Grande channel. Twelve radiocarbon ages were obtained from alluvial sediments. Three of these were on charcoal and wood, while the remaining nine were on organic sediments (Frederick and Higgins 1993). The two charcoal samples yielded radiocarbon ages of 80±60 and 40±60 yr. B.P., while the single wood sample was dated at 1960±60 yr B.P. (Frederick and Higgins 1993). Although the wood sample is considered problematic, the two charcoal ages suggest that near-surface sediments within the floodplain are very recent in age (i.e., modern). Frederick and Higgins (1993) also discuss the reliability of radiocarbon ages obtained from bulk soil humates versus those obtained from wood charcoal and conclude that the bulk soil dates are probably older than the actual age of the depositional episodes with which they are associated.

A fourth study of the age and stratigraphy of Rio Grande floodplain deposits was conducted by Hall (1994). Hall investigated the Rio Grande floodplain near El Paso, Texas using backhoe trenches, channel cutbank exposures, and radiocarbon ages (n = 14). One of the dates was obtained from a charcoal sample while the remaining 13 were on organic sediments (Hall 1994). The charcoal sample was collected from buried refuse associated with the Socorro Mission and yielded an age of 280±50 yr B.P. (Hall 1994). Hall's research focused on channel, overbank, eolian sand sheet, and eolian dune depositional environments (Hall 1994)

Presidio-Ojinaga Flood Control Project Area

In 2001, geoarchaeological investigations were conducted at the Arroyo de la Presa site, a Late Prehistoric campsite located on an alluvial terrace above the Rio Grande floodplain south of Presidio, Texas (Cloud 2004; Kuehn 2004). The geoarchaeological investigations focused on the interpretation and dating of fluvial stratigraphic units exposed in a 50 m long backhoe trench. The terrace on which the site is located was designated the T_{Oa} Rio Grande terrace by Abbott (2001). The surface of the terrace lies 4-5 m above the average water level of the current Rio Grande channel. The investigations were limited to the upper ca. 1.5 m portion of the terrace fill, which is comprised of fine to medium sand overbank sediments and interbedded silt drapes. A total of 38 radiocarbon ages, virtually all of which were on charcoal, suggests that the upper 1.5 m of the T_{Oa} terrace was deposited within the last ca. 2500 years (Kuehn 2004:193).

Lower Rio Grande Flood Control Project Area

Cooper et al. (2003) summarize geoarchaeological investigations conducted in the Lower Rio Grande Flood Control project area. The investigations centered on the excavation of 60 backhoe trenches from 30 localities within a portion of the modern Rio Grande floodplain between Penitas and Brownsville, Texas. The description of soils and sediments within the backhoe trenches was augmented by the procurement of 10 radiocarbon ages, all of which were from soil humates. These dates ranged from 1460±30 yr B.P. to 2140±40 yr B.P., with the exception of one sample that yielded an age of 310±30 yr B.P. (Cooper et al. 2003). Despite apparent internal consistency in the soil humate ages, Cooper and others (2003:86-87) argue, like Frederick and Higgins (1993), that the dates are probably a reflection of the age of organic matter in the samples, rather than the actual age of sediment aggradation. The Cooper et al. (2003) argument examines regional sedimentation rates, profile stratigraphy, soils, and erosional history. In short, the data presented by Cooper and others (2003) suggest that the radiocarbon ages obtained from soil humates sampled during the course of their investigations are probably too old and not an appropriate means for establishing a sound geochronological model for late Quaternary fluvial/deltaic activity in the Lower Rio Grande Flood Control Area.

These problems are consistent with current professional consensus that tends to view radiocarbon dates on soil organic matter as potentially unreliable. This is because organic matter in soils can accumulate from widely divergent sources, especially in alluvial settings where sediments are a product of numerous upstream depositional environments and/or derived from numerous types of exposed bedrock (Gilet-Blein et al. 1980; Martin and Johnson 1995; Wang et al. 1966; Wang et al. 2002). Within this context, it is suggested that a sound geochronological model for the aggradation and geomorphic history of the Rio Grande floodplain remains as yet to be formulated.

Gustavson and Collins (1998) summarize alluvial sequences at eight archaeological sites located within the Rio Grande Valley between Amistad Dam to the Gulf of Mexico. The study focused on floodplain and terrace morphology and age. Temporal context was provided by radiocarbon dates and diagnostic artifacts. The authors conclude that the Lower Rio Grande Valley can be divided into two distinct areas. Below Los Ebanos, Texas (just north of the Lower Rio Grande Flood Control project area), a series of terraces flank the sides of the valley while in the delta plain, modern sediment accumulation is occurring on natural levees and in flood basins (Gustavson and Collins 1998). The delta plain is apparently underlain by up to 30 m of Late Quaternary sediments, most or all of which have the potential to contain cultural resources. In the valley above Los Ebanos, three groups of terraces were identified. These are situated 18 to 20 m, 8 to 12 m, and less than 8 m, above the Rio Grande. The temporal data suggest that all three of these terrace fills are Holocene in age (Gustavson and Collins 1998).

Young et al. (1999) conducted geomorphic investigations in conjunction with archaeological monitoring of the Pemex Interconnect Pipeline in Hidalgo County, Texas. The investigations revealed that deep accumulations of sediment were deposited as Rio Grande overbank alluvium between ca. 500 to 700 years ago (Young et al. 1999).

International Tijuana River Flood Control Project Area

In the lower Tijuana River Valley (ITRFCP project area), geomorphic and archaeological investigations were conducted by Higgins et al. (1994a) in conjunction with monitoring of the International Wastewater Treatment Plant Land Outfall Trench. The research utilized stratigraphic sequences exposed along the trench cut, which was located along the southern margin of the Tijuana River Valley. Sediments observed in the 9-11 m trench wall reflect fluvial and estuarine depositional environments. The fluvial deposits included fine to medium laminated sands, and clay-pebble and cobble-sized gravels arranged in trough cross-beds (Higgins et al. 1994a:53). Estuarine deposits were represented by thin, organic-rich, fine sands, and muddy sands (Higgins et al. 1994a:54). Archaeological materials were encountered in deeply buried settings, some of which were associated with radiocarbon dates. In all, five radiocarbon dates were obtained on samples consisting of charcoal, marine shell, and peat. These ranged from 5970±70 yr B.P. to 2930±60 yr B.P. and were obtained from depths that ranged from 7 to 5 m below the surface (Higgins et al. 1994a:73-76).

CHAPTER 5
RESEARCH DESIGN AND DATA NEEDS

by

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IDENTIFICATION OF DATA NEEDS

Historical contexts, which generally identify important data needs and present research questions, are generally lacking for the regions under consideration in this document. There are however, book chapters and reports that explicitly summarize research issues for these regions (Church 2004; Cloud 2004; Cooper et al. 2003; Higgins et al. 1994a; various chapters in Perttula 2004) and adjacent areas (Abbott et al. 1996; Lintz et al. 2004; Sebastian and Larralde 1989). The following discussion of relevant and important gaps in our knowledge of the USIBWC project areas is summarized from these reports and documents, as noted.

For the whole of the project area – including each of the four separate stretches of the Rio Grande from Percha Dam in New Mexico to the mouth of the river at the Gulf of Mexico as well as the single stretch of the Tijuana River in California – there are at least seven primary research domains into which specific issues and questions may be grouped.

1. Chronology
2. Geoarchaeology
3. Settlement Patterns
4. Subsistence
5. Technology
6. Intra- and Extra- Regional Interactions
7. Historic Era Archaeological Issues

In the following pages, each of the research domains will be broadly outlined. Within each of these, several data needs are identified. These data needs cover the range of human occupancy and use of the five USIBWC project areas, from the Paleo-Indian period through the Historic era. For some of the topics, such as Chronology and Geoarchaeology, some questions that may cross boundaries from one project area to another are detailed.

Chronology Research Domain

Archaeological reconstructions and interpretations are generally reliant upon an adequate grasp of the local and regional chronologies. The relative and absolute dating of archaeological materials – through both direct and indirect means – is crucial to any project, being the basis for the development of culture-historical, processual, and post-processual issues addressed in other research domains (Lintz et al. 2004:5-2), discussed below. Cultural manifestations that do possess datable materials – including, but not restricted to, charcoal, ceramics, and certain stone tool forms – are necessarily more important than those that do not. Some issues that apply in general to the dating of cultural remains along a river's margins are listed below.

a) Is there the potential for datable materials to be found in association with archaeological remains within the project areas. Absolute dating, as mentioned above, is ideal, but much can also be done through indirect means and the use of relative dating methods. How have various riverine events affected the integrity of intra-site feature and artifact distributions and the stratigraphic integrity of different occupations? For example, light fraction materials like charcoal are easily transported out of site contexts by medium to high discharge events associated with channel, point bar, and crevasse-splay depositional environments (Waters 1992). Such materials, however, could remain preserved in low-energy facies environments like overbank fill in abandoned meander loops and oxbow lakes. There is currently a lack of understanding on these types of site formation processes.

b) Along the rivers in all USIBWC project areas, can we refine the chronology specifically for use of the river's margins? There are a number of gaps in the settlement sequences for these areas, about which we know little of specific use of the river corridor. For example, in the Rio Grande Canalization Project Area, there is just enough evidence to *suggest* an increased use of the river and its adjacent areas during the Middle Archaic period (Miller and Kenmotsu 2004). In the Lower Rio Grande Flood Control Project Area, there is an almost complete lack of archaeological remains with absolute dates, and, more specifically, a paucity of cultural remains dating to the Paleo-Indian period just inland from the Gulf Coast (Hester 2004; Ricklis 2004). In the Presidio-Ojinaga Flood Control Project Area, use of the river's margins prior to the Late Archaic period is almost completely unknown (Miller and Kenmotsu 2004). Are these gaps due to natural processes, such as aggradation, or are they due to actual gaps in the archaeological record related to lack of occupation and use? These issues, and other related ones, are discussed in more detail in the following pages.

Geoarchaeology Research Domain

Previous geoarchaeological research efforts in the Rio Grande and Tijuana valleys have addressed questions of archaeological site location and site preservation within floodplain, terrace, and/or alluvial fan environments. A review of these studies reveals significant data needs in the geoarchaeological understanding of the USIBWC project areas. These gaps, or research deficiencies, are summarized as follows:

a) The first major data gap in the USIBWC project areas is the paucity of reliable radiocarbon ages from charcoal samples. The crux of available dates from Rio Grande floodplain contexts have been obtained from bulk soil humates, and may reflect contamination by older carbon sources. These ages, therefore, could skew scientific understanding of late Holocene deposition rates within the floodplain and, consequently, archaeological expectations on the potential depth and age of sites associated with the floodplain environment. Additional geoarchaeological and geomorphic investigations should be conducted within the floodplain of the Rio Grande for the purpose of obtaining reliable charcoal dates that help establish a sound geochronology for aggradation and geomorphic development of the floodplain environment. Similar research is also recommended for the USIBWC portion of the Tijuana River so that future geoarchaeological research there can be placed on a firm geochronologic footing.

b) Although some information is available concerning the relative age, pedogenic content, and stratigraphy of Rio Grande and Tijuana floodplain sediments, geoarchaeological data from actual archaeological sites within the floodplain are very limited. In addition to data on the natural (i.e., stratigraphic and geomorphic) context of sites within the floodplain, what is almost totally absent is data related to the specific fluvial environments with which sites within the floodplain are actually associated. While sites on, or very near the surface, of the floodplain are located primarily in overbank deposits, what is the degree of site preservation in point bar, natural levee, crevasse-splay, and meander-scar/oxbow lake facies? Are archaeological materials preserved in these environments and if so, what is their integrity and archaeological context?

c) A review of existing site records indicates that numerous archaeological sites are located in terrace and alluvial fan settings along the margins of the Rio Grande Valley (Appendix A, Tables A.1-A.4). With few exceptions, like the Arroyo de la Presa and Berino-tract sites, the geoarchaeological contexts of terrace and fan sites are poorly understood (cf. Kuehn 2004; Kuehn et al. 2004). This paucity of information precludes the drawing of inferences regarding the age, distribution, and stratigraphic context of sites in fan and terrace settings in many portions of the Rio Grande Valley.

d) Some terraces and fans above the Rio Grande floodplain are Pleistocene or older in age. The surfaces of these landforms do contain archaeological sites, but information is lacking on their vertical and horizontal distribution. If significant alluvial deposition has not occurred on these landforms since Pleistocene times, there is a potential that archaeological materials from different cultural components and time periods could be condensed and mixed in palimpsest-like fashion on or very near the surface. What is the archaeological context and inherent research potential of these sites?

e) Finally, data are extremely limited concerning the extent of impacts to sites in both the Rio Grande and Tijuana River valleys from modern, i.e., historic, landscape modification and development. To what extent have sites been adversely affected in floodplain and terrace settings by agricultural practices, flood control and canalization projects, road construction, and industrial/urbanization development?

Settlement Patterns Research Domain

Settlement patterns refer to a regional scale of mobility, settlement, and general activity on the landscape (Lintz et al. 2004). For much of the project areas, and through most temporal periods, the populations that lived within and used the landscape were highly- to semi-mobile, using different ecological and environmental zones from which they obtained a variety of resources (subsistence, technological, and, likely, ideological), on a relatively regular basis. Combined with a good grasp of local and regional chronology, and the accurate dating of archaeological remains, an understanding of settlement patterns includes discerning changes in landscape use as other diachronic factors (e.g., technology, extraction of raw materials, subsistence) are also noted as changing. The logistical mobility noted for certain time periods within the project areas often can be correlated with specific landforms, and particular plant, animal, and raw material resources. This is a 'big topic' research domain that requires a compilation of archaeological site data (including previously recorded sites), and, as such, is particularly reliant upon understandings of the geoarchaeological setting of cultural remains. There are many specific questions regarding settlement patterns for all the five project areas, of which a few are illustrated below.

a) Our current understanding of the Middle Archaic period within the region encompassed by the Rio Grande Canalization Project Area, from Percha Dam to American Dam, in particular, suggests an increased use of river terraces and adjacent areas from the preceding Early Archaic period, but this is based on just a few documented sites (Miller and Kenmotsu 2004). Church (2004) suggests that there is a difference between the northern and southern parts of the river's margins in this region due to natural processes and not necessarily cultural ones. Are there deeply buried cultural resources in this project area that might increase our understanding of important trends tied to this time period and those immediately preceding and following it?

b) Some of the earliest historic documents describe populations of Mansos living along the river's margins (Miller and Kenmotsu 2004), presumably within the bounds of the Rio Grande Canalization project area. These people lived in *rancherias* and had a primarily hunting and gathering subsistence economy. Archaeological evidence of these populations, however, has been particularly elusive, in spite of the fact that the remains of these settlements should be relatively less deeply buried than some of the Archaic and Formative period sites that have been identified along the river's margins. Presumably, one reason they have not been found is due to problems with identification, though the burial issue also needs to be clarified within this project area.

c) Within the bounds of the Rio Grande Rectification Project Area, from American Dam to Fort Quitman, all indications are that the prehistoric residents were generally highly mobile and had a subsistence economy based on a broad spectrum of plant and animal resources (Miller and Kenmotsu 2004). Little is known, however, of the area along the river corridor itself, particularly for the Late Archaic period, where sites may be deeply buried. A broad-spectrum economy should include some settlement and use of the river's margins, but information on the seasonality of river corridor use is largely lacking.

d) In the Presidio-Ojinaga Flood Control Project Area, use of the river's margins prior to the Late Archaic period is virtually unknown. However, during the Late Archaic, there is evidence of settlement and use of the river's margins in areas that were not likely to flood (Cloud et al. 1994; Miller and Kenmotsu 2004). Are there also other areas within the project area that are not prone to flooding that might also have been used prior to the Late Archaic? Further, there are seemingly sedentary or at least semi-sedentary villages that are contemporaneous with the advent of technological changes associated with the Formative/Late Prehistoric era in this region. Some of the most important work on these sites was conducted early in the development of the science of archaeology (e.g., Kelley et al. 1940). More modern excavation and analyses methods, such as those reported by Cloud (2004), may contribute to a more thorough understanding of remaining questions regarding the origin and development of these villages.

e) Within the Lower Rio Grande Flood Control Project Area, inland from the mouth of the river, there is a clear lack of isolated finds and sites of Paleo-Indian period. Isolated finds of projectile points and sites are found both upriver and closer to the Gulf of Mexico, but have not previously been identified within this region. Given the environment, these sites may be deeply buried and Hester (2004) identifies this as an important research problem needing to be addressed through an understanding of the regional geomorphology.

f) In the deltaic plain, also within the bounds of the Lower Rio Grande Flood Control Project Area and very close to the Gulf of Mexico, so little is known archaeologically that we cannot determine at this point whether the residents were even mobile or sedentary.

Ethnohistorical data suggest that more than 10,000 people may have been living in the immediate deltaic region during the protohistoric and historic eras (Ricklis 2004). There was a rich environment there, which may have been able to sustain this and possibly even a larger population, possibly on a semi-permanent to permanent basis.

g) As part of a historic properties inventory for the USIBWC international water treatment plant, within the bounds of the present USIBWC International Tijuana River Flood Control Project Area, Wade and others (1991) developed an hypothesis regarding changing site densities between the Tijuana River mouth wetlands and adjacent areas away from the immediate river margins. The highest density of sites, as well as the largest residential sites, should be located closest to wetlands at the Tijuana River mouth (Wade et al. 1991). Higgins and others (1994a) attempted to test this hypothesis with data collected as part of a later USIBWC project, but were unable to because of limited information. This question is still worthy of further attention.

Subsistence Research Domain

This research domain refers to the strategies and methods used in obtaining and processing plant and animal resources (Lintz et al. 2004). Studies of subsistence require identifying the kinds of plant and animal resources used, an understanding of how these resources are and were naturally and culturally spread across the landscape, the methods and technologies used for ensnaring or hunting and trapping, and butchering, and other means of reducing the animal to usable parts, and the methods used in the collection and processing of plant resources, and the means of storing and cooking of both kinds of resources. While we do have some broad understanding of the subsistence strategies used throughout many of the USIBWC project areas during much of the time period involved, there are still numerous outstanding questions regarding subsistence, largely related to those of settlement as detailed previously. A few of those issues are discussed in the following paragraphs.

a) During the Late Archaic period in the Percha Dam to American Dam, Rio Grande Canalization Project Area, a major subsistence change included the adoption of cultigens and settlement in at least semi-sedentary villages. Throughout the Late Archaic and into the Formative period, there appears to have been an increasing reliance upon cultigens. There is a critical lack of data on the degree to which cultigens provided subsistence needs early on, how that changed or remained the same over time, and the degree to which cultigens were supplemented by wild resources such as those specifically found along the river's margins (Miller and Kenmotsu 2004).

b) In the Presidio-Ojinaga Flood Control Project Area, there is a relatively isolated development of settled villages, whose residents were practicing horticulturalists during the Formative era. Archaeological remains of these villages, located along terraces of the Rio Grande and Rio Conchos, include jacal pit structures, connected rectangular rooms with adobe bricks, associated ceramic assemblages, and various lithic tools. Whereas some of these characteristics – such as the use of adobe brick and ceramic assemblages dominated by typical Southwestern types (Kelley et al. 1940) – suggest a strong affiliation with the Jornada region of the extreme western Trans-Pecos and southern New Mexico regions, others – such as the projectile points found in the lithic assemblage – suggest a relationship with local hunting and gathering populations (Cloud 2004). The range of possibilities for these differences include the Bravo Valley Aspect having derived directly from the Jornada region, as through an actual migration of people (Kelley 1990), or as an *in situ* local development resulting from frequent contact with peoples in the Jornada region as well as with peoples around Casas Grandes in northern Chihuahua, Mexico

(Mallouf 1990, 1999). Good models exist for determining whether intrusive or new technologies, subsistence, and settlement patterns result from migrations, or inter- and extra-regional contact, as through trade relationships (Haury 1958; Rouse 1986).

c) Also in the Presidio-Ojinaga Flood Control Project Area, during the Late Prehistoric period and extending into Historic times, typically circular rock enclosures with associated lithic scatters are found in defensible locations; these have been identified as part of the poorly understood Cielo Complex (A.D. 1300-1700). Whether this complex represents a separate population from the La Junta region agriculturalists, or a distinct component of the subsistence and settlement strategy of the agriculturalists is a distinct gap in our understanding of the region.

d) Related to the issue of temporary or permanent residence in the deltaic plain within the Lower Rio Grande Flood Control Project Area is a more complete understanding of the seasonality and productivity of specific subsistence resources in the area. The prehistoric archaeology of this fragile, uncertain, and now-largely urbanized region is little known and almost any information on the subsistence resources and technologies of its residents would be an addition to the current data (Hester 2004; Ricklis 2004).

e) As with the other USIBWC project areas, the region through which the International Tijuana River Flood Control Project area runs is poorly understood with regard to the degree to which prehistoric residents relied specifically on riverine, bay/estuary, kelp bed, rocky area, and marine resources (see Noah 1998). Like on the Rio Grande deltaic plain (encompassed within the Lower Rio Grande Flood Control Project Area), this project area would have provided a variety of natural resources associated with both terrestrial and marine environments (Higgins et al. 1994a; Noah 1998), but few sites in the southern San Diego County area, much less ones along the Tijuana River, have both direct (faunal) and indirect (associated artifacts such as fish hooks) evidence of a subsistence economy in part or heavily reliant on fishing (Noah 1998). An important question that this raises for the Tijuana River Valley relates to whether the paucity of evidence for fishing is due more to geomorphic and/or site formation processes, such as having been very deeply buried along the river's margins, or cultural processes, such as an actual lack of use of the Tijuana River Valley for occupation and, more importantly, subsistence-related activities.

Technology Research Domain

Technology refers to the way that items are made and used, encompassing much of the use-lives of ceramics, chipped and ground stone artifacts, architecture, and other site features. An understanding of technology consists of three components: 1) the organization of production; 2) the raw materials, primary tools, and features needed to conduct specific tasks; and, 3) the knowledge and skills necessary to conduct specific tasks (Lintz et al. 2004:5-6). Like the other research domains, there are numerous challenges in reconstructing technological strategies and patterns. Among both mobile and semi-mobile populations, artifacts and features representing only a fragment of the overall pattern will be present at any given location, as many artifacts are curated from location to location across the landscape and others are lost (due to accidental drops, and ending use-lives, among other reasons). Given mobility patterns, technologies may also be brought entirely or partly to a new location, then removed in part and taken to a new location. We try then, to discern from remaining objects, features, and residues the activities and processes that happened at a particular site. Good site preservation and brevity of occupation with quick burial are the best conditions for preserving evidence of these activities. A sampling of important questions relating to an understanding of technologies follows.

a) For the Rio Grande Canalization Project Area, from Percha Dam to American Dam, there is presently a greater understanding of ceramic and ground stone technologies than for chipped stone technologies (Miller and Kenmotsu 2004). Some outstanding questions for chipped stone artifacts apply, in particular, to the Late Archaic to Formative period transition, where changing projectile point forms and reduced sizes characterize this temporal boundary, and the points themselves tend to have fewer blade modifications. What do these changes indicate about larger issues, such as settlement and subsistence along the river's corridor, involved in the transition from the Late Archaic to the Formative era,? As mentioned above, the riverine component of Formative period settlement is largely unknown. Will a larger sample size of chipped stone assemblages dating to either side of this temporal boundary help in achieving a greater understanding of these, and other, technological trends?

b) In the Trans-Pecos region of Texas, including the area encompassed by the Rio Grande Rectification Project, there is an outstanding question about the lack of change in some of the broadest technologies (Miller and Kenmotsu 2004). In the westernmost part of this region as well as in the upstream and adjacent Rio Grande Canalization Project Area, the Formative period is marked by a more sedentary lifestyle, and an increasing reliance on cultigens. There is certainly evidence to suggest that these adjacent populations were interacting, and thus presumably sharing information, yet those to the east continued to cling to the predominant use of technologies characteristic of the preceding Late Archaic period. Just south of Fort Quitman (and thus just outside the project area), Johnson (1977) has reported ring middens, hearths, and lithic scatters in association with Formative period ceramics and arrow points, thus indicating that local populations knew of, and were likely familiar with, Formative period technologies, but instead diverged and continued to use many of their own patterns established during the Late Archaic.

c) Understanding of ceramic technology in the Presidio-Ojinaga Flood Control Project Area has increased greatly with the development of baseline Instrumental Neutron Activation Analysis (INAA) and petrographic analysis data for ceramic sherds associated with Bravo Valley Aspect Formative/Late Prehistoric period sites (Cloud 2004). These, however, are just baseline data consisting of an analysis of 32 artifacts from two sites; additional sherd analyses will be required from a variety of ceramic types before more firm conclusions can be drawn about local technologies and inter- and extra-regional trade networks.

d) In the Lower Rio Grande Flood Control Project Area, technological questions are largely tied as well to issues of chronology. During the Middle Archaic period, for example, sites are often found only through the identification of projectile points that may be cross-dated to the Middle Archaic in regions far to the west and upriver (Lower Pecos area), the north (Central Texas), and the northeast (along the central coastal plain; Hester 2004). Without direct, or at least more direct, dating of artifacts in this specific area, it will continue to be difficult to understand how local technologies may have changed over time.

e) Within the Lower Rio Grande Flood Control Project Area, but inland from the coastal region, chipped stone technologies are well represented in the archaeological record, but are not well documented at their sources (Hester 2004). Large chipped stone scatters are present along the river corridor, where river gravels were exploited for raw materials. These sites however, are very large and, as a result, have been relatively under-documented and under-studied. Hester (2004:129) suggests that such quarries need to be studied and should be analyzed specifically with regards to correlating the lithic reduction sequences at quarries with tool types represented at sites away from the river's margins to understand distinct settlement patterns and subsistence strategies on the landscape.

f) Technological changes through time within the bounds of the International Tijuana River Flood Control Project Area include a very early development of ground stone technologies, possibly as early as the San Dieguito Complex (10,000-7,500 B.P.), but certainly by the time of the La Jolla Complex (7,500-2,000 B.P.; Higgins et al. 1994a:31) and through the Late Prehistoric period. Different types of ground stone – for example manos and metates versus mortars and pestles – were used for processing different types of plant resources. How drastically and quickly these technologies changed through time, and how their frequencies differ across space from the coastal to more inland areas might be used as proxies for understanding changes in subsistence strategies.

Intra- and Extra- Regional Interactions Research Domain

Intra- and extra-regional interactions may be discerned archaeologically through the identification of raw materials from which certain artifacts are made, studies of the technological processes through which raw materials are shaped into objects, and the final forms in which objects are found. Broad understandings of technologies, settlement, and subsistence are all basic prerequisites for discerning the differences between local and non-local objects and resources, though some, such as particular kinds of stone, pottery, or minerals, may be immediately obvious (Lintz et al. 2004). From the presence and identifications of exotic or non-local materials and objects, we may be able to deduce interaction networks across space and, if well dated, time; thus allowing us to determine how intra- and extra-regional networks may have changed or stayed the same. As among the other topics discussed previously, there are significant questions remaining about interactions for all the project areas, some are integrated in the research issues discussed above, while others are discussed individually below.

a) There is an interesting change in territorial use from the Archaic to Formative periods in the region included within the Rio Grande Canalization Project Area and most of the area covered by the Rio Grande Rectification Project. The territorial use of the region during the Archaic period was predominantly a north-south pattern; during the Formative period, it was oriented east west (Miller and Kenmotsu 2004). Whether this is related to corresponding changes in intra- and extra-regional networks is an interesting and important question that needs further investigation, particularly with a project area like the current one that extends across a broad expanse of territory. There is evidence, for example, of fewer exotic lithic materials from the Late Archaic to Formative periods. Is this change merely associated with the use of smaller territories, or does it also reflect changing networks from extra- to merely intra-regional ones?

b) In the areas encompassed by the southeastern part of the Rio Grande Rectification Project Area and the Presidio-Ojinaga Flood Control Project Area, there appear to have been both agriculturalists and hunter-gatherers living on and very near the river during the Historic era (J.C. Kelley 1986; Miller and Kenmotsu 2004; Riley 1987). The relationships between these two populations – and between these peoples and the Spanish – are almost completely unknown, because they are only briefly mentioned in historic documents.

c) There are some very intriguing suggestions for unusual extra-regional interactions in the area encompassed by the Lower Rio Grande Flood Control Project during the Late Prehistoric period. The Brownsville Complex, defined in the area around the deltaic plain, has been identified in this region, and includes some very strong evidence for relatively long-distance interactions with populations in northern Mexico and, more importantly, northern Mesoamerica (Hester 2004; Ricklis 2004). Certain types of ceramics, obsidian from specific Mexican source areas, jadeite, and serpentine have all been found at some

Brownsville Complex sites and larger questions about the implications of such long-distance interactions would certainly benefit from additional data.

d) In the International Tijuana River Valley Flood Control Project Area, there has been some difficulty in gaining chronological control over many of the archaeological sites (Higgins et al. 1994a). This has led almost directly to a lack of understanding of interactions between local, *in situ* populations and the intruding Yuman-speakers during the Late Prehistoric Period. This may represent a replacement of populations – such as the local, La Jolla Complex groups being pushed to the north by the Yuman-speakers – or there may have been substantial interactions between the populations, but sites dating to the transition between the two periods will have to be investigated.

Historic Era Archaeological Issues

There are 178 Historic era components known within the five USIBWC project areas. These range from seventeenth century Spanish era settlements, presidios, and water control features to early twentieth century stores, institutions, and theaters. Though there are numerous historic documents that report on events that occurred at or around these sites, and important modifications, additions, and movements to these structures over time, archaeological investigations can add significant information to fill in a number of data needs that presently exist. A few of these are detailed below.

a) The Spanish strategy of settling a new area on the frontier consisted of three elements: a presidio, missions, and ranchos (Cooper et al. 2003:43). The presidio was distinctly military in nature, under the rule of a military commanding officer, and its function was to guard the missions and the frontier from attack by hostile indigenous populations, as well as invasion by the French and English. Structures associated with presidios included homes, church, barracks, a guardhouse, storage, and a powder magazine, built around a central square. Missions, by contrast, were set up to establish control over indigenous populations through four steps (Almaraz 1979:5-6):1) establishing the mission for gentiles (natives presumed to have no formal religion), 2) reduction or gathering and confinement of indigenous into specific areas, 3) conversion (process of Christian religious instruction), and 4) the legal change of the mission community from a temporary administrative arm of the church into a fully recognized parish of the local church and part of the administrative structure of the state. The mission compound included a church, sacristy, a convento, shops for spinners, weavers, tailors, etc., and a granary. Ranchos were set up on the frontier to provide meat and other resources for the occupants of the presidios and missions. Fox (1989:91) identifies as a major data gap the lack of archaeological investigation of presidios, missions, and ranchos on the Spanish frontier (but see Vierra et al. 1997b). There should be various important differences between the three structural types, and changes that took place in the methods of fortification throughout the Spanish period (Fox 1989:91). These two project areas (Rio Grande Rectification Project Area and the Presidio-Ojinaga Flood Control Project Area) also offer an opportunity to compare the Spanish strategies in two regions in which indigenous populations differed, as well as the strategies needed for agricultural production, protection, and holding together the frontier.

b) Throughout the historic era, settlements were focused on the river and immediately adjacent areas. The Rio Grande has been subject to variations in river flow, floods, and avulsions, which have affected adaptation strategies and related activities, such as movement of fields, houses, and entire villages (Scurlock 1997). Fox (1989) has identified information gaps in Rio Grande settlements in general, and this certainly applies to the El Paso, Presidio, and Lower Rio Grande areas. Acequias, canals, levees, and other water control features were certainly built within the current project areas (as some are actually recorded as being present in the USIBWC Rio Grande Rectification Project Area and the Lower Rio Grande Flood Control Project Area; see Appendix A, Table A.4). Historic documents reference some such activities, particularly for the El Paso area, but little has been done archaeologically with regard to the relationships between early settlements and the river's geomorphic history.

c) There are several important military forts within the Rio Grande Canalization and Rectification project areas, the Presidio-Ojinaga Flood Control Project Area, and the Lower Rio Grande Flood Control Project Area. Sites known to exist within the USIBWC project area include Fort Selden, Fort Thorn, Fort Bliss, Fort Hancock, Fort Quitman, Fort Leaton, and Fort Brown. The forts were established for the protection of pioneers and settlers, to define boundaries, and to support military campaigns. Supply chains were set up to provide for the various needs of the personnel at the forts; these were often supplemented by trade with local residents. How did these supply chains and local interrelationships change through time, especially given other technological changes that took place, such as the construction of the railroad and changing style of watercraft? The numerous forts that lay along this project corridor allow for numerous comparisons to be made, given their different natural and cultural milieu.

CHAPTER 6
SUMMARY AND RECOMMENDATIONS

by

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There are numerous known cultural resources located within all of the USIBWC project areas. In the previous chapters, we have presented the results of a comprehensive file search, summarized previous research, and provided environmental and historic contexts for cultural resources within the Rio Grande and Tijuana River project areas. In this chapter, we discuss geoarchaeological site potential, identify areas about which little is known regarding site distributions, and describe types of archaeological remains that would contribute to filling the present gaps in our knowledge of the USIBWC project areas. We conclude with general recommendations for future cultural resource investigations and how potential resources might be identified and evaluated.

GEOARCHAEOLOGICAL SITE POTENTIAL

Geoarchaeology contributes to the question of cultural resource expectations by helping to identify the age, distribution, and stratigraphic context of landforms likely to contain archaeological sites. The summary of previous geoarchaeological studies conducted in the USIBWC project areas provides useful data on site location and preservation. The following expectations apply to all of the USIBWC project areas within the Rio Grande River valley:

(1). The cumulative data suggest that archaeological materials are likely to be present in the upper ca. 1 to 3 m portion of the Rio Grande floodplain fill, which is generally characterized by relatively fine-grained overbank sediments. In some areas, the floodplain sediments interfinger with and/or are vertically adjacent to, distal alluvial fan and arroyo mouth deposits. In floodplain environments in particular, archaeological materials located in the upper portion of the fill, are likely to be relatively recent in age, perhaps even dating to within the last century. The chronology for sediment aggradation in the floodplain remains poorly defined.

(2). Archaeological sites older than ca. 1000-2000 yrs B.P. are likely to be very deeply buried, making their discovery and interpretation difficult. Geological investigations in the Albuquerque Basin portion of the Rio Grande valley in New Mexico suggest that sediments within the floodplain date from the late Pleistocene through the Holocene. Therefore, the floodplain in at least some portions of the valley has the potential to contain archaeological sites dating back to Paleo-Indian times. In other words, the entire archaeological chronological sequence could be represented within the floodplain environment.

(3). Archaeological sites are not likely to be preserved in active or former channel settings, or in vertical accretion deposits in general due to the high energy discharge conditions associated with these environments (Waters 1992).

(4). One characteristic of the Rio Grande floodplain not generally discussed in previous geoarchaeological reports, but which is relevant to the question of archaeological site preservation, is the process of channel avulsion. As previously discussed, avulsion is a process involving the abandonment of a former river channel and the establishment of a new channel during high-energy flood events (cf. Walker and Cant 1984; Waters 1992). Depositional environments associated with avulsion-prone stream systems include oxbow lakes, which are often filled with "clay plug" deposits. Oxbow lakes were often attractive settings for prehistoric occupations and the associated "clay-plug" sediments have good potential for archaeological site preservation because of the erosion-resistant nature of the fine-grained materials (Waters 1992:137-143). For these reasons, oxbow lake facies within the Rio Grande Valley are considered to have high archaeological research potential.

(5) The available data suggest that sites are also preserved in Holocene-aged terrace deposits above the modern floodplain. These deposits, however, are only located in a number of segments along the Rio Grande valley due to variations in valley geometry, bedrock lithology, and sediment yield from tributary streams. A good example of Holocene terrace preservation is the area around the Arroyo de la Presa site south of Presidio, Texas (Cloud 2004).

(6) Other portions of the Rio Grande Valley, like stretches of the river between Percha Dam and American Dam, are characterized by a low incidence of Holocene-age terraces, because most post-late Pleistocene Rio Grande alluvium is stored within the current floodplain (Los Padillas Formation or equivalent). In these settings, sites are located above the floodplain, but in alluvial fan and arroyo mouth environments. A good example of sites in alluvial fan settings is the Berino-tract south of Las Cruces, New Mexico. Here cultural components are buried both in fine-grained alluvial fan deposits and in overlying sand sheet sediments, which were deposited after major aggradation of the fan.

(7) Finally, some portions of the Rio Grande Valley contain very old (i.e., Quaternary and Tertiary) terrace and alluvial fan surfaces high above the current floodplain. These surfaces are evident in the Percha Dam to American Dam (Rio Grande Canalization Project), American Dam to Fort Quitman (Rio Grande Rectification Project), and Presidio (Presidio-Ojinaga Flood Control Project) areas, where they are labeled as QTs (Upper Santa Fe Group), Qp (piedmont alluvial gravels), and Tsf (Tertiary portion of Santa Fe Group)(Texas Bureau of Economic Geology 1992; New Mexico Geological Society 1982)(see Figures 2.1-2.5, Chapter 2). These are stable landforms whose surfaces have not witnessed significant sediment aggradation since at least Pleistocene times. The important geoarchaeological characteristic of sites associated with these landforms is that they are located on, or very close to, the stable surfaces and are not generally found in buried contexts. This results in palimpsest-like accumulations of cultural materials, often from different time periods and from multiple occupations that may become mixed on the same surface. Sites located in these contexts may or may not retain significant archaeological research potential.

AREAS WITH UNKNOWN SITE POTENTIAL

A very small part of the total floodplain and adjacent localities within the USIBWC project areas has been surveyed for cultural resources. Consequently, most of the rivers' corridors must be considered broadly as having unknown site potential. It is appropriate however, to clarify some of the other issues that have affected the identification of cultural resources along the rivers' corridors to date.

As sites are largely documented through cultural resources management projects, the number of sites along a given section of river is partially dependent on the amount of survey that has been conducted. As such, the recently built environment (e.g., El Paso, Texas or much of the Lower Rio Grande) contains a much higher density of known cultural properties than more rural areas.

Less than 1 percent of the total area examined for this project has been subjected to cultural resources inventory. Areas that have been subjected to intensive cultural resources survey within the floodplain have generally contained few sites. For example, a survey of 210 acres was conducted on US-IWBC lands between Percha Dam and Mesilla Dam and a single site (LA 107943) was documented (Adams 1995). On the other hand, some of the densest concentrations of known resources occur in areas that have been continuously occupied since the Spanish entradas; sedentary people, such as farmers and missionaries, leave a much heavier footprint than more mobile populations. The longer an area was permanently settled, the greater the likelihood of finding cultural resources.

Sites found in most areas of the floodplain have been discovered primarily through plowing of fields and backhoe trenching. For example, within the Rio Grande Canalization Project Area, two buried historic canals (LA 131868 and LA 131869) were identified during trenching conducted by Brown and others (2001) near the town of Arrey, New Mexico. These irrigation features may have been abandoned during the initial canalization efforts during the 1930s and 1940s (Brown et al. 2001).

Historic period sites and features found on or just below the ground surface include houses, buildings, structures, bridges, forts, and other historic properties that are 50 years or older and not associated with irrigation. The significance of these sites may be derived under Criteria A, B, C, and possibly Criterion D (36 CFR 60.4). These sites may be identified on the floodplain or within terrace fan contexts.

Future projects conducted by the USIBWC are apt to occur within the direct vicinity of the Rio Grande and Tijuana River channels. Irrigation features are considered important to understanding the past and current agricultural efforts in these valleys. Their significance may be derived under National Register of Historic Places (NRHP) Criteria A and C, and possibly D. All irrigation features in New Mexico and Texas have the potential to be considered eligible for inclusion in the NRHP if they are 50 years or older, regardless of whether or not they have been formally documented. Any modification to significant irrigation features would require documentation and consultation with State Historic Preservation Officers to determine the appropriate course of action.

Historic Spanish, Mexican, and Anglo occupations of the Rio Grande and Tijuana River areas are possible within the ca. 1 to 3 m of the surface. Such resources may include buried irrigation features such as those identified by Brown and others (2001), remnant house walls or floors, such as those identified by Miller and O'Leary (1992), or other cultural deposits. The significance of these sites may be largely derived under Criterion D. These sites may be identified in the floodplain or within terrace/fan settings.

Surface sites dating to the prehistoric period may be identified within floodplain contexts, but they are much more likely within terrace/fan settings, where applicable. Site types in this category include prehistoric artifact scatters (lithic debris and tools, ceramic, ground stone, and faunal materials), fire-cracked rock features (including hearths and middens), trash middens, and structures (including pithouses and pueblo room blocks). Within the context of the Tijuana River, shell middens are also possible. Very old surfaces (terraces and fans) that have remained essentially stable may contain prehistoric surface assemblages. The significance of these sites is determined under Criterion D only.

Subsurface sites dating to the prehistoric period may be identified within both floodplain and terrace/fan contexts. Within the floodplain, sites dating to this period may be deeply buried, and their context may be difficult to interpret. Previously documented floodplain sites are extremely rare in the Rio Grande Canalization and Rio Grande Rectification project areas. One prehistoric site (41EP2841) has been documented within the plow zone in the lower valley of El Paso (Anthony et al. 1992). Within subsurface contexts in the International Tijuana River Flood Control Project Area segment, several prehistoric sites have been documented, with some features buried to a depth of 7 meters (Higgins et al. 1994a). The significance of these sites is determined through the application of Criterion D only. Subsurface prehistoric sites may be more prevalent along some sections of the river, based on the perceived attraction to prehistoric groups. These include remnant oxbow lakes, areas where the river flows close to terraces or fans, and areas where canyons or wide arroyos empty onto the floodplain. Based on the presence of previously identified village sites on the terraces and fans along the Rio Grande Canalization and the International Tijuana River Flood Control project area segments, buried sites in the nearby floodplains could be numerous. Intact prehistoric cultural deposits – in other words, those with contextual integrity – within the floodplain could be significant.

Depending on the depth of disturbances then, intact archaeological deposits as well as other historical features may be present along several stretches of the two rivers. Geoarchaeological understanding of the rivers' geomorphic processes – such as avulsion, aggradation, and channel migration – must be considered as basic to determining the potential for buried cultural resources along any of the project areas.

IMPORTANT SITE CRITERIA – DATA NEEDS

Seven research domains were posited in order to establish contexts for the evaluation of cultural resources in the USIBWC project areas. These research domains identify important deficiencies in our present knowledge base of previously identified cultural resources. Each of these is a broad topic that covers multiple cultural and physiographic regions, and many of them are applicable to several temporal periods. Six of these research domains are discussed in the following paragraphs in order to establish an initial framework for site evaluation, and the types of data that will be needed to address these deficiencies; geoarchaeological issues have been addressed previously.

Chronology

There are significant research deficiencies regarding how and when the riverine zone was used in all project areas; this is due, in part, to a lack of understanding of the geomorphic processes affecting archaeological deposits in riverine environments (see discussion above). Chronometric dating techniques, such as radiocarbon dating of culturally associated remains, are those that would be most relevant for providing missing information on prehistoric use of the river and its margins. However, relative sequences and other approximations would also serve to strengthen existing chronologies. Sites with appropriate datable materials (e.g., charcoal), especially those associated with features retaining contextual integrity, should be considered potentially significant.

Settlement Patterns

There are numerous deficiencies in the realm of settlement pattern data. These include nearly all time periods, where there are uncertainties about the specific use of the riverine environment. For some of the early time periods, riverine sites may be deeply buried and thus not encountered; study of the geoarchaeological issues will help resolve this. For later time periods, particularly the Protohistoric and Historic periods, where there are documented cases of indigenous populations using and, in some cases, living on, the river's edge, sites may not be deeply buried and could be encountered on or just below the surface. Late Prehistoric/Formative and even Late Archaic sites might also be found within 1-2 m of the modern ground surface in some areas.

Determination of site density, noted as a data gap for the Tijuana River project area, also hinges upon a geoarchaeological understanding of the floodplain environment. This applies as well to virtually all of the Rio Grande project areas. Subsurface investigations would be needed to further address the questions of site density and distribution in the floodplain. The identification of cultural resources within the floodplain and adjacent areas is a prerequisite to understanding settlement patterns and use of these environments.

Subsistence Patterns

Interrelated with settlement data, subsistence patterns are also poorly understood for areas adjacent to and on the rivers' floodplains. In particular, issues of marine and riverine resource use are limited for most of the project areas; they are largely missing for the Lower Rio Grande Flood Control Project Area because of a paucity of documented prehistoric cultural resources. Preservation of faunal remains then will be very important in addressing this issue.

For most of these regions, we have some direct and indirect archaeological data from nearby sites that are outside the project areas, which suggest use of riverine resources; direct evidence includes, for example, faunal remains of fish, while indirect evidence includes fish hooks and other evidence for aquatic resource procurement. Analyses of fish otoliths, as by Eling and others (1993), may also be used to determine seasonality of site use and resource procurement.

The river's edge was also used, particularly in the Rio Grande Rectification and Presidio-Ojinaga Flood Control project areas, for the cultivation of domesticated resources during the Late Prehistoric/Formative periods. These two instances of agriculture and settlement, in fact, have been argued to be related, given broad similarities in technology as well. A longstanding issue has been to try to clarify the relationships of the populations in the two areas and determine if the developments in the Presidio region stemmed from those in the Jornada region. Detailed analyses of artifacts – including geochemical comparisons – and exposures of architecture for comparison between the two areas may help address this issue. A comparison of the general archaeological remains from sites very close to and a little farther away from the river's edge may also help to clarify apparent relationships between hunting and gathering and farming groups who lived nearly side-by-side in the Presidio-Ojinaga Flood Control Project Area in the Protohistoric and early Historic eras. Sites with preserved floral and faunal remains should be considered potentially significant.

Technology

There are several different technologies represented in the known archaeological record from the rivers and their immediate margins. Deficiencies in our knowledge about these technologies in particular include changes in lithic, ceramic, and ground stone technologies and styles through time, particularly for the Rio Grande Canalization and Rio Grande Rectification project areas. In the Lower Rio Grande Flood Control Project Area, lithic resource procurement areas – in reality, Rio Grande and Pleistocene gravel exposures near the river– should be studied to determine technological differences from campsites and other short-term activity sites in adjacent upland areas.

The sourcing of ceramic raw materials is also needed for sites dating to the Bravo Valley Aspect in the Presidio-Ojinaga Flood Control Project Area to help determine the kinds of networks these people maintained with outside areas. Along the Tijuana River, technological differences in groundstone and their differential distributions need to be understood between coastal and inland sites to better understand the different types of plant resources that were being exploited. Sites containing tool assemblages, concentrations of artifacts, and other items representative of various technologies, particularly those with good contextual integrity, would be considered to have research potential.

Intra- and Extra-Regional Interactions

The identification of exotic goods can often be used in order to define interaction networks across space and time. In the case of prehistoric groups, this can often be accomplished through analyses of ceramic and lithic artifacts from dated archaeological contexts. In the case of historic interactions, the presence of metal and glass and their stylistic characteristics can also be used.

The movement of people, however, is a more complicated endeavor that requires some archaeological or historical knowledge as well of both the areas of origin and destination. Patterns of architectural and artifact distributions across space and time can be used to bolster such arguments. Geochemical sourcing of artifact origins can again be used in cases where postulated movements of populations may have occurred. Additionally, the presence of the river made its probable use as a travel corridor likely, and further development of this aspect of the river as a research issue is needed. Cultural deposits containing a diversity of artifacts, items that may be accurately sourced, and, to some degree, diagnostic, should all be considered as having potential significance.

Historic Era Archaeological Issues

It is likely that numerous Historic period sites and features will be found within the current USIBWC project areas. In particular, based on known historic sites in the project areas, Spanish and early American military properties are important to understand, and may not be deeply buried. The Spanish settlement strategy focused on floodplains and terraces and consisted of three major elements: missions, presidios, and ranchos. The strategy to protect the frontier under American rule consisted of a fort system, around which other settlements were established. There are major data needs in archaeological understandings of the relationships between these various settlement elements, and the current USIBWC project areas may provide opportunities to compare them across a broad expanse of space and time. More of these site types need to be systematically investigated in order to alleviate these deficiencies.

An important aspect of historic settlement in the project areas is the focus on riverine environments. As geoarchaeological research demonstrates, the Rio Grande, in particular, has been subject to variations in river flow, avulsion, and channel migration that have in turn affected adaptation strategies and use of riverine resources for thousands of years. Little is presently understood about how populations adjusted to accommodate such processes. Historic sites and features maintaining contextual integrity with relation to these and other important and related issues could shed light on the rich and diverse cultural and natural environments of the Rio Grande region.

SUMMARY AND RECOMMENDATIONS

Within the 382 miles of the Rio Grande and five miles of the Tijuana River examined for this project, 302 previously recorded cultural properties were identified within one-half mile of the river within the United States boundaries. Of those, 123 were identified in the Rio Grande Canalization Project (RGCP) segment, 60 were identified in the Rio Grande Rectification Project (RGRP) segment, 28 were identified within the Presidio-Ojinaga Flood Control Project (POFCP) segment, and 71 were identified in the Lower Rio Grande Flood Control Project (LRGFCP) segment. Twenty sites were identified within one-half mile of the Tijuana River in the International Tijuana River Flood Control Project (ITRFCP) area. The temporal components of these sites are summarized in Table 6.1.

Table 6.1
Previously Recorded Site Temporal Component by River Segment

Segment	Prehistoric	Historic	Prehistoric and Historic	Unknown
RGCP (n=123)	66	29	11	17
RGRP (n=60)	3	54	0	3
POFCP (n=28)	5	17	4	2
LRGFCP (n=68)	3	65	1	2
ITRFCP (n=20)	16	3	1	0

The Cultural Riverine Environment

Based on the site data table (see Appendix A), an examination was conducted on where prehistoric and historic temporal components are identified between the floodplain and the terraces/fans (Table 6.2). Sites of unknown temporal component were excluded from Table 6.2. Approximately 95 percent of the search corridor for the previously identified sites fell within the floodplain category (see Table 6.2). However, within the upper portions of the Rio Grande (Rio Grande Canalization Project Area, Rio Grande Rectification Project Area, and Presidio-Ojinaga Flood Control Project Area), prehistoric sites identified in relation to these projects were located primarily on the terraces and fans overlooking the floodplain. The lower Rio Grande section (Lower Rio Grande Flood Control Project Area) consists entirely of the floodplain, and very few prehistoric sites have been documented within one-half mile of the river channel.

Certain site and feature types are commonly represented, such as resource procurement and agricultural properties, because these types of sites are frequently associated with riverine environments. Sites may also be obscured or destroyed by flood and channel activity and by agricultural practices.

Table 6.2
Previously Recorded Temporal Components and Environment by River Segment

Segment	% of sites in Floodplain	Prehistoric Floodplain (%)	Prehistoric Terrace/Fan (%)	Historic Floodplain (%)	Historic Terrace/Fan (%)
RGCP	90	28	72	65	35
RGRP	95	33	67	97	3
POFCP	90	43	57	0	100
LRGFCP	100	100	0	100	0
ITRFCP	95	85	15	50	50

Summary of Significant Existing Resources

Within the Rio Grande Canalization Project Area, several significant village sites associated with the Archaic and Formative periods were identified during the archival search, including The Garfield Site (LA 1082), Rio Vista Ruin No. 2 (LA 50749), La Cabrana Pueblo (LA 1671), Los Tules (LA 16315), The Mesilla Dam Site (LA 854), LA 50743, Cristo Rey Site (LA 1644), Hatch Site (LA 3135), Chavez Cave (LA 5220), and the Sandy Bone Site (LA 98732). Prehistoric irrigation features may also exist within the floodplain of the Rio Grande at the Lucky Devil Site (41HZ491; Hubbard 1992).

Historic sites were identified primarily on the floodplain. Historic sites tended to be associated with modern agriculture, defense (historic forts), and city functions (businesses). The Rio Grande Canalization Project and Rio Grande Rectification Project areas are located within the Elephant Butte Historic District and El Paso Water Improvement District No. 1, respectively. Numerous irrigation features, including diversion dams, levees, canals, laterals, and drains have been erected since the late 1600s, when the Spanish first built missions in this area. Many irrigation features are listed on the national or state registers, including Percha Diversion Dam, Leasburg Diversion Dam, Leasburg Canal, Mesilla Diversion Dam, American Dam in the Rio Grande Canalization Project Area, Franklin Canal in the Rio Grande Rectification Project Area, and in the Lower Rio Grande Flood Control Project Area, the Louisiana-Rio Grande Irrigation Canal System (district).

Extensive levee building and other flood control projects have occurred along all of the sections of the Rio Grande included in this document. These levees are considered important features in defining historic use of the Rio Grande (Chapter 3; also see Cooper et al. (2003) for an excellent discussion). Significant Historic period military properties along the pertinent sections of the Rio Grande include Fort Thorn and Fort Selden in the Rio Grande Canalization Project Area, Fort Bliss at Hart's Mill and Fort Quitman in the Rio Grande Rectification Project Area, Fort Leaton in the Presidio-Ojinaga Flood Control Project Area, and Palmito Hill Battlefield District and Fort Brown in the Lower Rio Grande Flood Control Project Area. Future research throughout the Rio Grande Valley use the archival efforts presented by Cooper and others (2003) as a model.

Within the International Tijuana River Flood Control Project segment, the remains of Millejo Village (SDi-10669), a Kumeyaay habitation site documented by Spanish explorers (Shipek 1976), may still exist. This village was possibly buried or destroyed by the extensive flooding events of 1896 and 1915 (Shipek 1976). This site was examined by Higgins et al. (1994a), and trenching revealed features to a depth of 7 meters. Also within the Tijuana segment is a 1-meter deep shell midden site (Sdi-16293), buried within a depth of 2 m.

Recommendations

At this time, specific recommendations regarding future cultural resource investigations are not possible because proposed actions have yet to be identified. Prior to any Section 106 undertaking, intensive cultural resources survey should be conducted to determine if surface artifacts or features are present. Depending on the depth of the potential impact disturbance, backhoe trenches may be required to determine if subsurface cultural deposits are present that retain contextual integrity. Remote sensing techniques, such as ground penetrating radar, may also prove useful to determine the nature of subsurface deposits. The depth of trenches, shovel probes, and other subsurface investigations should match the depth of any proposed impact.

There is an expectation that significant cultural resources may be encountered during any future project that is undertaken within the Rio Grande and Tijuana River floodplains and terraces. The determination of site significance is dependent upon the assessment of sites' and features' contextual integrity, types of data that are present, and the applicability of that data to important local and regional research needs. As defined by the United States Department of the Interior (1990), the requirements that must be met before a site can be eligible for inclusion in the National Register of Historic Places (NRHP) are defined by four criteria set forth in 36 CFR § 60.4:

> The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, setting, materials, workmanship, feeling, and association, and:
>
> (A) that are associated with events that have made a significant contribution to the broad patterns of our history, or
>
> (B) that are associated with the lives of persons significant in our past, or
>
> (C) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction, or
>
> (D) that have yielded, or may be likely to yield, information important in prehistory or history.

Archaeological properties may be considered eligible for inclusion in the NRHP primarily, under Criterion D and potentially under Criteria A and B. Significance is dependent upon contextual integrity and the potential of the data to yield information important for an understanding of prehistory or history; in other words, significant sites must contribute to the elimination of regional research domains and perceived data needs.

A cultural property retains contextual integrity if it still reflects the original three-dimensional spatial arrangement of artifacts, features, and other associated remains. Particularly in floodplain settings, cultural properties are likely to have been subjected to displacement and other damage by flooding and channel migration. The potential damages are greatest in areas of high-energy discharge, such as stream channel and lower point bar environments; preservation of integrity is greatest in areas where deposition has occurred within a low energy environment, such as oxbow lakes and areas of overbank sedimentation.

A site's significance is also determined by its potential contribution to perceived data needs. As described in Chapter 5, and summarized below (Table 6.3), the data needs are defined according to knowledge disparities in the seven identified research domains.

Table 6.3.
Summary of Data Needs

Significance	Data Need
Chronology	Datable material in archaeological contexts (all areas)
	Chronological sequence along the river corridors (all areas)
Geoarchaeology	Charcoal radiocarbon dates (all areas)
	Data on specific floodplain environments (all areas)
	Information from site on terraces and alluvial fans (all areas)
	Archaeological context of palimpsest sites
	Extent of damage to sites by historic developments
Settlement Patterns	Information from deeply buried contexts (all areas)
	Archaeological evidence of Manso and other Spanish documented aboriginal groups (RGRP)
	Information regarding the Rio Grande during the Late Archaic (RGRP, POFCP)
	Data from Paleo-Indian contexts (LRGFCP)
	Data from Protohistoric contexts (LRGFCP)
	Site density information (ITRCFP)
Subsistence Patterns	Cultigen information (RGCP)
	Information regarding the relationship between Jornada-Mogollon and La Junta groups (POFCP)
	Information on Cielo complex structures (POFCP)
	Information on seasonality (LRGFCP)
	Information on the use of terrestrial and marine resources (ITRFCP)
Technology	Information on changes in lithic styles through time (RGCP)
	Evidence of cultigens, projectile points, features (RGCP, RGRP)
	Information regarding ceramic sources (POFCP)
	Information on lithic sources (LRGFCP)
	Evidence of artifacts in relation to time periods (LRGFCP, ITRFCP)
Intra- and Extra-regional Interactions	Information regarding the movement of groups across the landscape (RGCP, RGRP)
	Information regarding the interaction between native and Spanish groups (RGCP, RGRP)
	Information regarding long-distance trade (LRGFCP)
	Information regarding the interaction between La Jolla complex sites and Yuman groups (ITRFCP)
Historic period data needs	Information on Spanish settlement strategy
	Information on military fort system, supply chain and relations with locals
	Information on the use of the riverine environment and accommodation to riverine processes

Expectation of Cultural Resources

Potentially significant cultural resources are likely to be encountered during future proposed projects on USIBWC lands along the Rio Grande and Tijuana River valleys. A summary of the expected cultural resources, their likely riverine environmental locations, and criteria under which their significance would be determined is presented below in Table 6.4.

Table 6.4
Summary of Expected Cultural Resource Types

Type of Resource	Examples of Resource Types	Environment	NRHP Eligibility Criteria
Historic Sites and Features	Diversion dams, laterals, drains, acequias, levees, structures (e.g., houses, barns, sheds, etc.), bridges, forts, battlefields, factories, shops, burials and cemeteries	Floodplain, terrace, fan, channels, and adjacent tributaries	A, B, C, D
Prehistoric / Protohistoric Sites and Features	Artifact scatters, villages, pithouses, pueblos, thermal and other features, trash middens, structures, lenses, burials and cemeteries, stone circles, rock art	Floodplain, terrace, fan, channels, and adjacent tributaries	D

Conclusions

The location of water played a significant role in the lives of prehistoric and historic people in arid regions. Permanent sources of water, such as the Rio Grande and Tijuana River, may have been more attractive to humans than seasonal streams, springs, or pools left after summer thunderstorms. Such a watercourse provided reliable water and a concentration of aquatic and land-based faunal resources, as well as a diversity of exploitable floral materials. In addition, the river provided substantial other resources including fuel wood, housing materials, and lithic resources. The river also served as a corridor, allowing easy travel along its banks, and as a boundary or trading locale of sorts, between various groups. During the later Historic period, these rivers served again as corridors of travel for the Spanish, Mexican, and later American pioneers. Along the Rio Grande, forts were established because of the permanent water, and agricultural communities were built. With agriculture came a network of dams and acequias. It is within this context that cultural resources along these watercourses can best be interpreted and managed.

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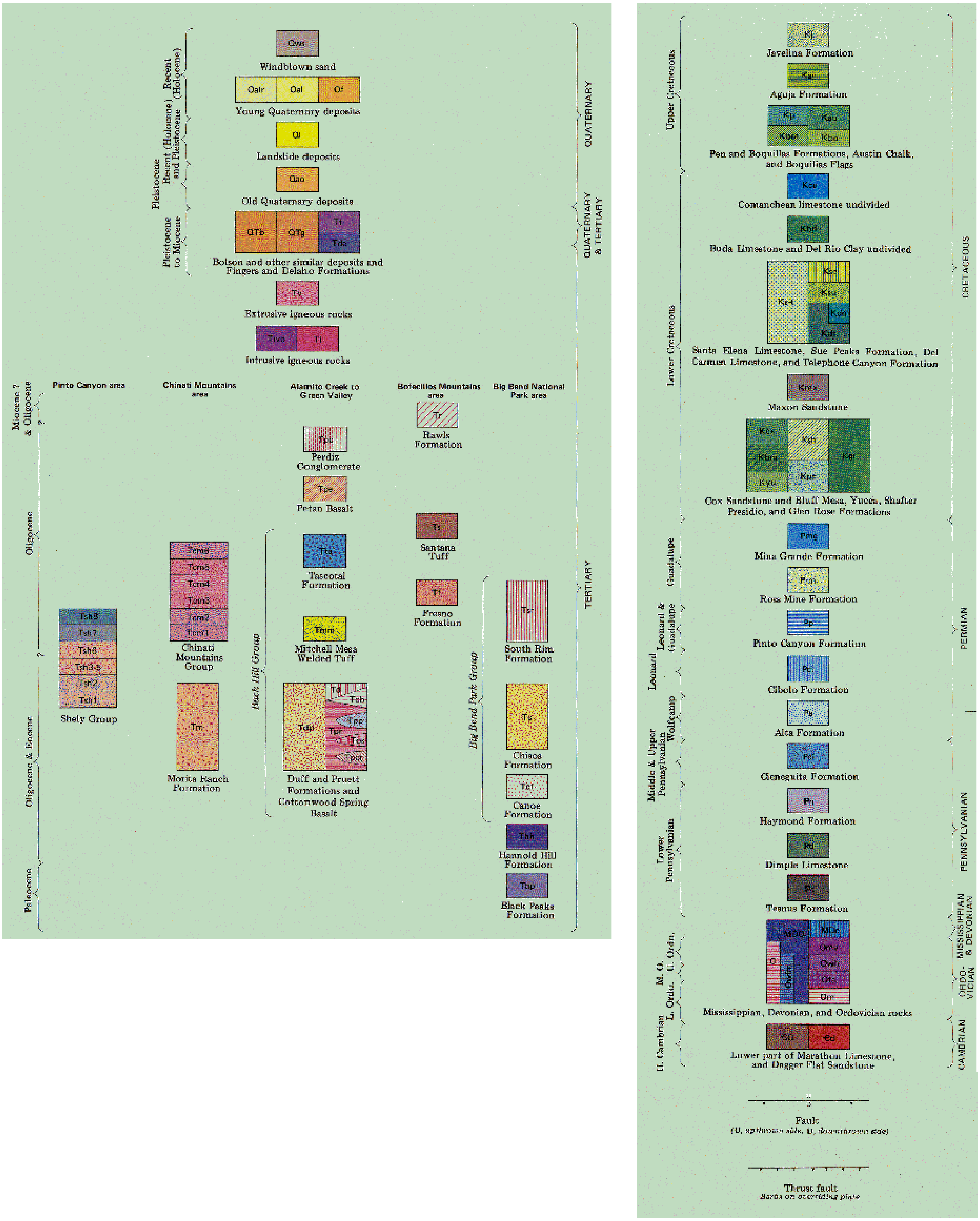
APPENDIX A
PREVIOUSLY RECORDED SITE DATA COMPENDIUM

Table A.5. Cultural Resources for the Tijuana River Flood Control Project

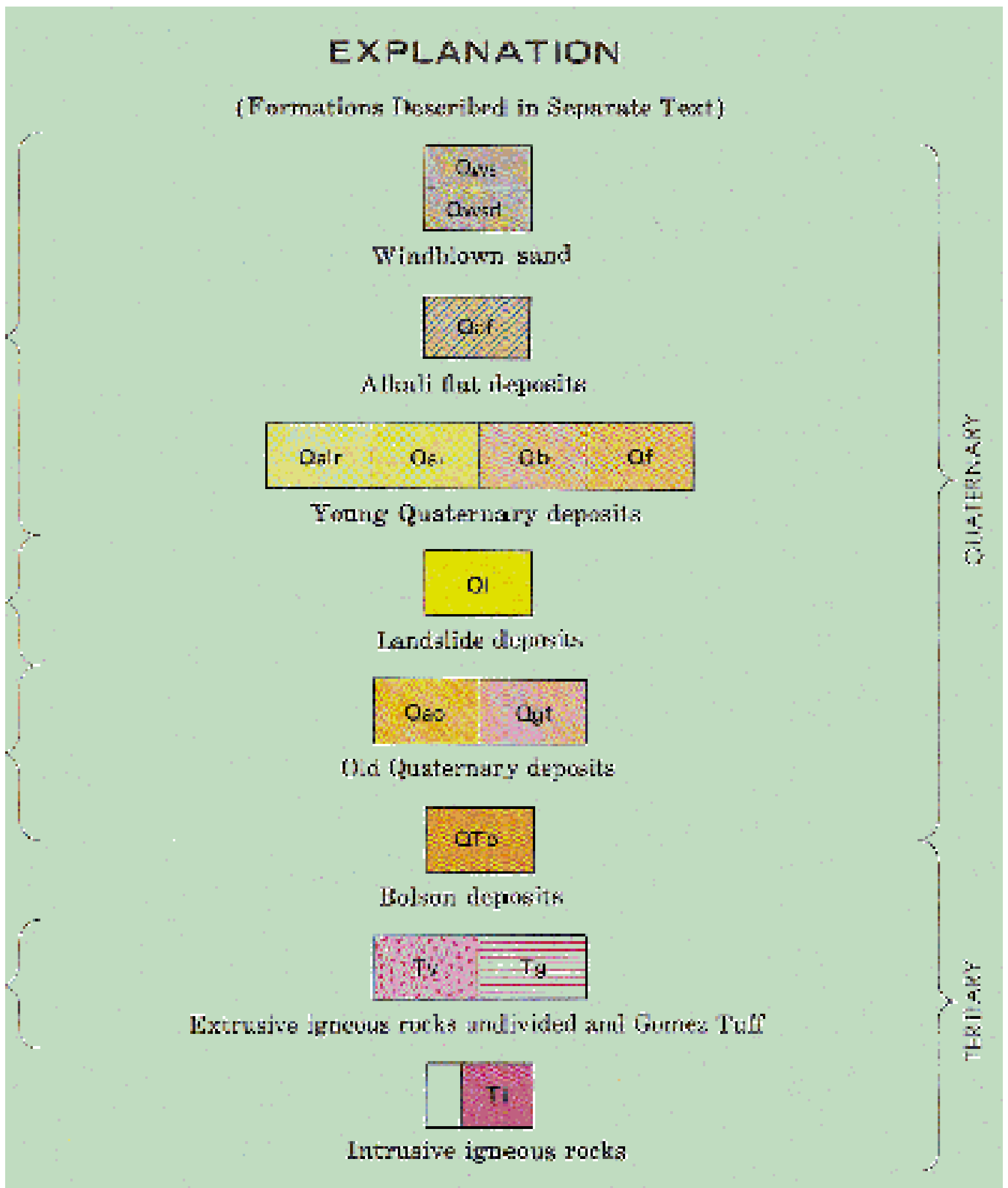
Site Number	County	Quad Map	Site Name or comment	Zone	UTM E	UTM N	Age/ Cultural Affiliation	Geomorphic Setting
SDI-4934	San Diego	Imperial Beach	aka SDI-12962	11	495210	3601890	UP	Floodplain
SDI-7456	San Diego	Imperial Beach		11	490860	3600760	UP	Floodplain
SDI-9181	San Diego	Imperial Beach		11	488810	3602270	UP	Floodplain
SDI-10486	San Diego	Imperial Beach		11	491380	3602480	UP	Terrace
SDI-10487	San Diego	Imperial Beach	multiple locations	11	491902	3601960	UP	Floodplain
SDI-10488	San Diego	Imperial Beach		11	490550	3600640	H (Lt 1800s)	Terrace
SDI-10669	San Diego	Imperial Beach	Millejo Village	11	491100	3600920	A, H (Lt 1800s)	Floodplain
SDI-10967	San Diego	Imperial Beach	Sancti Spiritu	11	490873	3601322	UP	Floodplain
SDI-11099	San Diego	Imperial Beach		11	492980	3600600	LP	Terrace
SDI-12023	San Diego	Imperial Beach		11	492070	3600580	H (1900s)	Terrace
SDI-12455	San Diego	Imperial Beach		11	488110	3601880	UP	Floodplain
SDI-13487	San Diego	Imperial Beach		11	490550	3600700	UP	Terrace
SDI-13488	San Diego	Imperial Beach		11	490680	3600795	UP	Floodplain
SDI-16293	San Diego	Imperial Beach	shell midden	11	489755	3601273	UP	Floodplain
SDI-17098	San Diego	Imperial Beach	exposed in road	11	490528	3601297	UP	Floodplain
SDI-17236	San Diego	Imperial Beach		11	490283	3601187	UP	Floodplain
SDI-17237	San Diego	Imperial Beach		11	490393	3601076	UP	Floodplain
SDI-17238	San Diego	Imperial Beach		11	490406	3601207	UP	Floodplain
SDI-17239	San Diego	Imperial Beach		11	491902	3601960	UP	Floodplain
SDI-17240	San Diego	Imperial Beach	Hollister Street Bridge	11	496145	3601538	H (1930s)	Floodplain

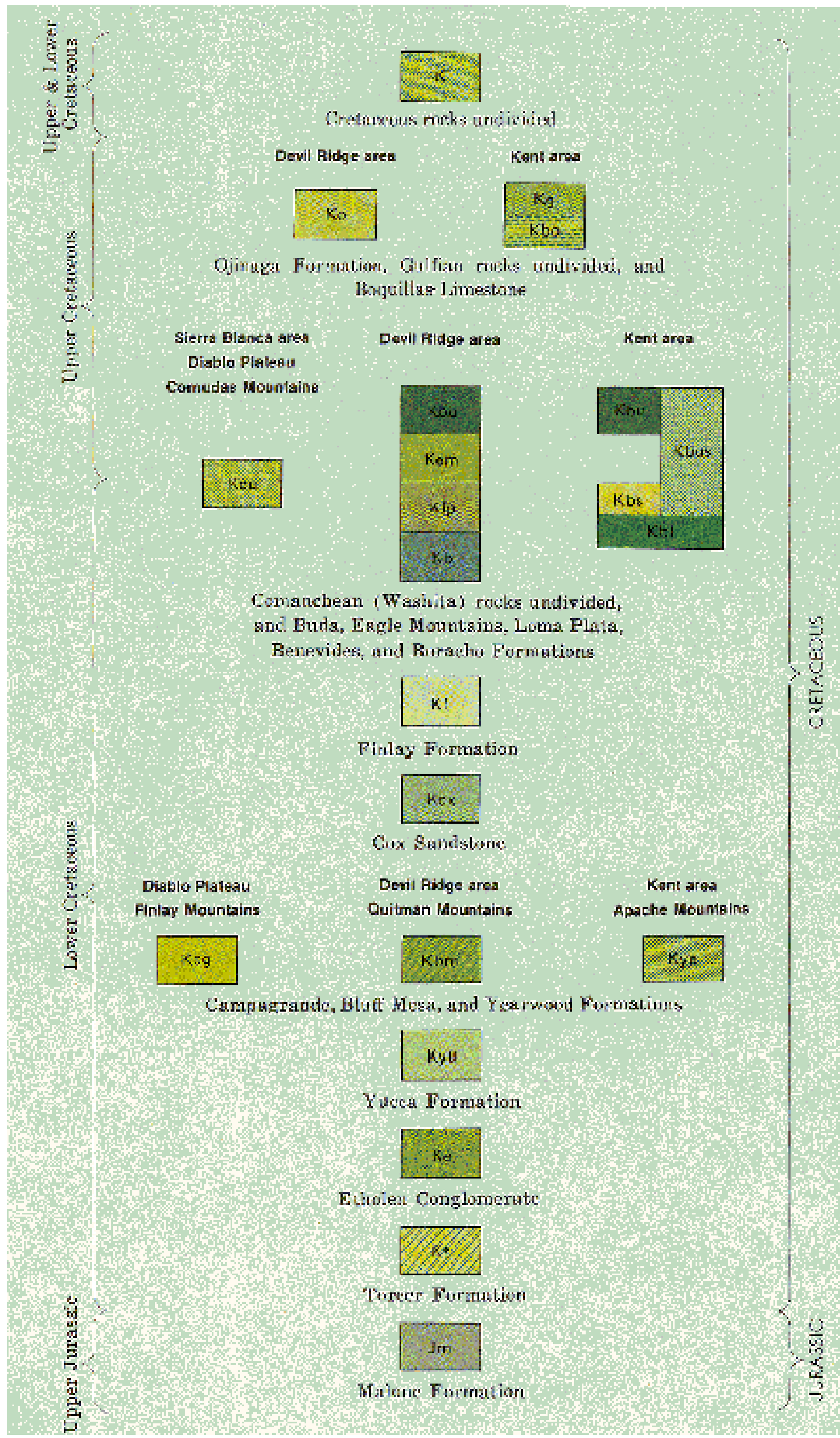
Size (sq m)	Ground Stone	Lithics	Ceramics	Bone or shell	Human Remains	Prehistoric Features	Prehistoric Structures	Historic Artifacts	Historic Features	Historic Structures	Work Phase	Eligibility
9000		x		x				x			e	unk
unk		x				x					s	unk
270,000		x		x							s	unk
900		x		x							s	unk
7632		x		x							s	unk
400								x	x		s	unk
640,000	x	x		x				x			e	unk
280,000	x	x		x							s	unk
5625	x	x	x	x							s	unk
2500										x	s	unk
100		x		x		x					s	unk
unk	x			x		x					e	unk
unk	x	x		x		x					e	unk
75,000				x							e	unk
51	x	x									s	unk
731	x	x		x							s	unk
1300		x		x							s	unk
1584		x		x							s	unk
2542	x	x		x							s	unk
unk									x		s	unk

APPENDIX B
COLOR KEYS TO GEOLOGIC MAPS (CHAPTER 2)

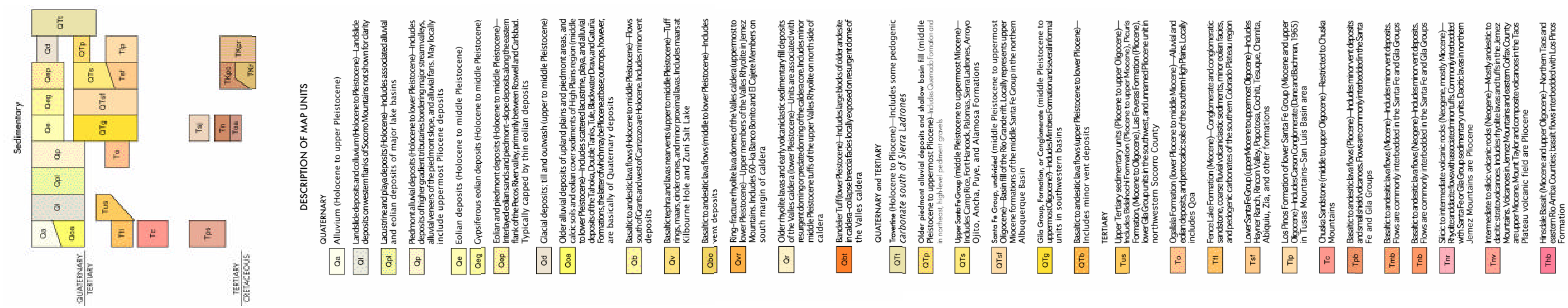


Color key code for the Presidio-Ojinaga Flood Control Project Area (Figure 2-5).





Color key code for the Rio Grande Rectification Project Area (Figures 2.2-4).



Color key code for the Rio Grande Canalization Project surface geology map (Figure 2-3).